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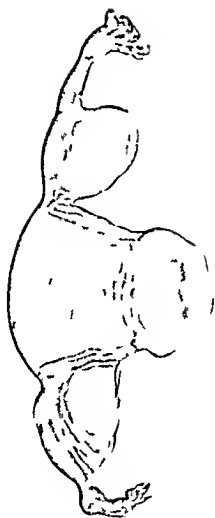
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# SURGERY, GYNECOLOGY AND OBSTETRICS

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## TUBERCULOSIS OF THE CERVIX UTERI

WITH REPORT OF A CASE

By G. A. MOORE, M.D. BRISTOL, MASSA HUSSETT

SCIENTIFIC study of tubercular lesions of the female genital organs dates back about one hundred years. One of the first if not the first authoritative paper on this subject was published in 1831 by Raymond, a French writer describing typical tubercular lesions. Lebert and Rokitsky, however, disagreed with Raymond and stated that it was impossible to make a diagnosis of genital tuberculosis in the living female.

Little or no further investigation was made of tuberculosis of the genital organs judging from the literature up to 1886 when Hegar published his monograph *Die Entstehung, Diagnose und chirurgische Behandlung der genital Tuberculose des Weibes*. This work, which has been referred to by numerous recent writers on genital tuberculosis marks an epoch of advance and is still considered one of the great masterpieces on this subject. Tubercular involvement of the genital organs secondary to urinary tuberculosis was first described by Virchow.

Following Hegar's work a voluminous literature has appeared on tuberculosis of the tubes, uterus, ovaries, vagina and vulva, but comparatively little study has been given to tubercular lesions of the cervix. A result of the lack of study of this subject is reflected in modern textbooks on gynecology, the majority of which devote very little space to these lesions. And to the

general practitioner who frequently refers to textbooks for aid in diagnosis the descriptions found of tubercular lesions of the cervix are rarely helpful and often misleading. To quote from two recent authors as examples:

The cervix is rarely infected by tuberculosis. When this does occur the infection is usually primary. The appearance is that of an irregular ulceration. Tuberculosis of the cervix usually appears as a caseous ulcerating process but in some cases forms a hyperplastic vegetating outgrowth which resembles a venereal wart or early papillary carcinoma.

The chief reason for the apparent general lack of interest in this subject is the invulnerability of the cervix to invasion by the tubercle bacilli. Williams states that except for the vulva the cervix is found involved with a tubercular infection in fewer cases than any organ in the female genital apparatus. The stratified pavement epithelium with which the vaginal portion of the cervix is covered probably offers a strong barrier to infection and the tenacious secretion from the cervical canal with which the cervix is constantly bathed has been proved by Menge to be very strongly bactericidal. This author injected various pathogenic organisms into the cervical canal and twelve hours later found the secretions from the cervix sterile. Stengal makes note of the

fact that tubercle bacilli have never been found in vaginal excretions. In case of tubercular involvement of the peritoneum and uterus Merletti was able to obtain tubercle bacilli from the cervix by cannula when they could not be found in the discharge from the cervix.

While tuberculosis of the cervix is very rare indeed and undoubtedly many cases have been diagnosed early as cancer, syphilis, etc. without histological study. There is no doubt that many cases of early cancer of the cervix diagnosed from the clinical symptoms which have received prompt relief after conservative operations were tubercular.

Spicth reported 6 cases of tuberculosis of the cervix. Zwarglum in 1888 reported 1 case being primary. Hever in 1901 reported 10 cases being primarily primary and 2 others probably primary infections. In 1902 Williams stated that 1 case had been reported in the literature. Primary cases had been reported by Fraenkel, Vot, Emmanuel, Kaufmann and others. Since that time many other cases have been reported as a result of routine histological study of specimens removed for high rate of infection. Among the earliest and undoubtedly primary infections of the cervix have been reported by Fowler 1900, Crett 1900, Brink 1903, Kynch 1903, Young 1902, Ilersik 1908 and Vinberg 1908.

It can be readily seen from the foregoing statement that primary tubercular infection of the cervix is extremely rare. It is probably not more than 1 or 2 cases have been reported. A primary infection we should include only those cases in which the cervix is the only organ involved. Where other distinct organs are involved it is impossible to rule out an hematogenous infection even though infection by an external route seems plausible.

Of the secondary tubercular infection of the cervix probably about 150 have been reported. This probably represent only a small percentage of all cases and undoubtedly many have passed by unobserved or have been diagnosed cancer, syphilis, etc. Veysit cites that in 2 per cent of all cases of pulmonary tuberculosis in men the patient have tuber-

cular infections of some part of the genito-urinary system. This percentage probably would apply to women. Eden and Lockyer found that the cervix affected in about 8 per cent of all cases of tuberculosis of the female generative organs. Williams found that Johns Hopkins Hospital that one out of every twelve operation for removal of the tube and ovary for inflammatory disease was due to tuberculosis. He further stated that 1 per cent of all cases of genital tuberculosis would have passed by unnoticed in a hysterectomy except for routine microscopic examination at the time of the operation. In his experience he is certain that 75 per cent of all cases of genital tuberculosis are unnoticed by the general surgeon. Comparing the figures of Veysit, Eden and Lockyer and Williams we find that about one sixth or one fifth of the per cent of all pulmonary tubercular cases in women have tuberculosis of the cervix.

The portal of entry to the bacilli in the secondary case as well as in the primary still is a wide field for study. Veysit states that tubercle bacilli probably are carried by the blood stream in genital infection more often than by any other means. In experiment carried out by Laffargue tubercle bacilli were obtained from the blood stream in two cultured guinea pigs. Out of 50 cases of tuberculosis of the cervix reported by Veysit 35 had pulmonary tuberculosis. This is a much higher percentage of pulmonary involvement as a cause of infection of the cervix than most investigators have found. This figure probably can be discounted somewhat. Veysit does not state how many cases had an involvement of other genital or primary organs.

The next most common route of infection of the cervix is by direct extension of a tubercular process from the tube, ovary or uterus or by infection from the cervix or vagina passing over the cervix into the uterus.

In connection with this subject the mode of infection of the generative organs is of interest not only in the secondary case but in the true primary case as well. In cases where an active process in the lung cannot be demonstrated a healed or dormant process

cannot be ruled out as the focus from which the process in the genital organs originated. Undoubtedly many cases of genital tuberculosis arise by direct extension from some process in the intestines or urinary apparatus. This is probably a reason for the frequency of tuberculosis of the tubes. According to Hegar 10 per cent of all tubal infections are tubercular. Trienkel was the first to call attention to the fact that the cervix may be involved in a tubercular process secondary to the tubes and the uterus be free. The same observation has been made by several other writers. In many other cases the uterus has been found involved coincidentally with a process in the cervix. These facts prove conclusively the incorrectness of Rokitsinsky's statement that the internal os is a barrier to descending or ascending tubercular infections. Of less frequency as a focus of infection of the generative organs are the foci in bones joints etc.

External means as a method of infection of the genital organs have been a subject of much interest to investigators of these lesions. The most frequent method by which bacilli are brought in contact with the female genitalia from external sources is by coitus. The other means are by handling with unclean hands and the use of unclean gloves, hands or instruments in making examinations. The latter are doubtless far less frequent causes than coitus. Infection from external sources is undoubtedly the cause of primary lesions of the cervix and a large number of tubercular lesions in the other genital organs can be attributed to it.

In coitus bacilli are brought in contact with the female genitals in two ways: first by handling the genitals before coitus with hands soiled with tubercle bacilli or by the use of sputum for a lubricant from a person with pulmonary tuberculosis. Hegar, Späth and others state that infection is frequently borne in this way. Hammer<sup>1</sup> cites a case of a husband with pulmonary tuberculosis who used his sputum for lubrication at coitus. His sputum contained tubercle bacilli. His wife became infected and at autopsy tubercular tubes were found.

Veyrat and Pozzi assert that inoculation with tuberculosis may occur by simple contact without erosion or solution of continuity of the cervical mucosa. Curt Jani found tubercle bacilli in the epithelium of the epididymis tubules of patients with phthisis. The testicles were not diseased. He also showed that tubercle bacilli would pass through normal capillary membranes. These conclusions were confirmed by Veigert and Gartner. Several other investigators have found tubercle bacilli in healthy testes of patients dying from phthisis. We may conclude that tubercle bacilli may pass through healthy organs in the genital tract in patients with phthisis without causing any pathologic change just as patients with tubercular cervical adenitis may have no demonstrable lesion in the tonsils or lungs.

The fact that after passing into or through the healthy genital organs tubercle bacilli are carried by the spermatic fluid must be accepted to borrow a legal phrase on circumstantial evidence alone. This applies also to cases in which the genital organs in man are the seat of a tubercular process. Although much careful search has been made tubercle bacilli have never been demonstrated in the semen. Cornil, Fernet and Derville, Curt Jani, Schuckart, Laudouzy and Martin, Gartner and others have shown that bacilli may be carried by the spermatic fluid. Derville proved in five women with genital tuberculosis that the husband of each had tubercular epididymitis. Martin cited by Jannin<sup>1</sup> reports a case of tubercular salpingitis occurring six weeks after marriage to a tubercular patient. Pfannenstiel, Prochownik, Kelly and Merletti have reported cases of genital tuberculosis in women whose husbands were suffering with tuberculosis of the testes. Stengel however states that women with genital tuberculosis have husbands in most cases with pulmonary tuberculosis but no infections of the genitals. It would seem that there is sufficient evidence in the literature to prove that coitus is the cause of many cases of genital tuberculosis in women. We have no statistics to show how many cases of tubercular lesions of the cervix are due to

some lesion in the husband. Probably all of the primary cases can be attributed to this cause and doubtless a large percentage of the secondary cases.

There are four different varieties of lesions of the cervix commonly mentioned and two others that occur in very rare instances. They are classified according to their anatomical and microscopical form: (1) military (2) interstitial (3) vegetating (4) ulcerating, the rare forms are (5) catarrhal form of Schutt (6) inflammatory form of Little. In the majority of cases all types begin in the cervical canal only occasionally on the vaginal portion of the cervix. In the later stages all type of lesion develop into the ulcerative form resulting in a purulent vaginal discharge and more or less hemorrhage.

1 *Military form* This is a rare form. Beyer states that only two cases had been reported before 1901, one by Virchow the other by Carnal. According to Karyoch the military type of lesion is in early stage of ulceration. Tubercular granulation more or less extensive are to be seen on the cervix. These do not differ from the military type of lesion found in other organ. The background is red tubercles protrude some are small running together some are isolated. Some are half transparent others yellow. This type is frequently associated with military tuberculosis in other parts of the body.

2 *Interstitial form* Vejrát states that this type of infection is almost impossible to diagnose clinically. The whole cervix may be enlarged and pituitous or small and conical shaped with a small orifice. In the true interstitial type there are no lesions of the mucosa the infected area usually in the form of tubercles are within the muscle bundles or surrounded by connective tissue in the stroma. In the later stages the tubercles break through the mucosa forming ulcers the epithelium becomes thickened resembling carcinoma. Frequently malignancy occurs coincidentally with tuberculosis.

3 *Vegetating form* This is also called the proliferating or papillary type by many authors. The process begins in the cervical endometrium especially the lower portion

and may extend to the vaginal portion of the cervix. In the early stages there is a hyperplasia of the mucosa later developing into fungous masses of pink color. In some cases they become sessile attaining the size of cherries. In rare cases they obstruct the canal causing pyometra. They are soft and friable bleeding readily on palpation resembling the papillary form of carcinoma for which this type of lesion is frequently mistaken. Their soft velvety feel however is a distinguishing characteristic. Like the two preceding types the vegetation often become necrotic forming ulcers.

4 *Ulcerating form* This is the most common type and has been mentioned is a little type of the first three forms in many cases. In other ulcer may be found in conjunction with other types of lesions. The ulceration is usually the most prominent lesion. Murphy stated that the ulcers seemed to commence near the external os spreading over the vaginal portion of the cervix and up the canal. The ulcer may be large and single or small and multiple tending to coalesce. There is a complete loss of substance the border of the ulcer are clear cut or punched out with a tendency to phagadenism. They are usually covered with necrotic material which on being removed reveals whitish yellow or grayish bases. The floor of the ulcer is soft and there is an absence of marked induration and friability which distinguishes this type of lesion from squamous called carcinoma. The cervix is usually hypertrophied and the os patulous. Frequently there is a spreading of the ulceration to the vagina. During the later stages there may be a complete destruction and excoriation of the cervical canal and the vaginal portion of the cervix about the os. Vejrát describes a form which resemble an endometritis of the neck of the uterus to which are added tubercular nodules. The nodule coalesce the mucosa becomes infiltrated and undergoes caseous degeneration becoming granular and yellowish throughout liquefaction ensues and on removing the detritus the ulceration appears. These lesions at time invade the muscular bed.

5 *Catarrhal form of Schutt* This is a

rare form localized histologically in the superficial epithelium and glands of the neck. On examination the appearance is not dissimilar to a simple endocervicitis. In the case of Schutt which has served as a basis for diagnosis in later cases the lumen of the glands of the neck were filled with grayish masses the epithelium of the glands was detached in places and in the submucous and muscular layers about the vessels there was an infiltration of round cells. The diagnosis was made on finding numerous bacilli on section.

*6 Inflammatory form of Collé paratubercular lesion.* The existence of histological tubercular lesions would not be necessary to make a diagnosis of this type. This form is based upon a case in which the glands were hyperplastic with sclerosis of the rest of the neck. In no section was histological tubercular formation found. The relative frequency of the different types of lesions is given by Chuton<sup>1</sup> in a study of seventy seven cases ulcerating form 37 proliferating or vegetating 2 military 7 ulcerating and proliferating 6 ulcerating and military 5.

The microscopic appearance of tuberculosis of the cervix depends upon the stage of the disease and the type of lesion. Tubercular follicles may be isolated or confluent in different stages of evolution accompanied by an intense inflammation. The process is often found extending along the course of the vessels with involvement of the deep intermuscular tissues causing necrosis of muscle bundles. The glands often undergo hyperplastic changes the cells becoming enlarged and the secretions abundant. Tubercular infiltration may develop in the interglandular spaces blocking up the neighboring glands so that they appear as solid columns of cells. Retrogression changes finally occur resulting in necrosis and cisation. Giant cells are rarely found in the glands proper. During the earlier stages the glands may become papillary polypoid or dendritic resembling carcinoma or as Emmanuel says the glands and stroma may hypertrophy resembling adenoma. The malpighian epithelium covering the vaginal portion of the

cervix may present zones of necrosis and neighboring zones of hyperplasia. Papillae develop interpapillary prolongations of epithelium burrow into adjacent tissue appearing malignant. Alterthum stated that he found not only a degeneration and proliferation of epithelial cells but a concentric disposition of cells resembling cancerous pearls. Diagnosis in such cases is very difficult in view of the fact that in a certain number of cases tuberculosis and cancer have co existed in the same case.

*Military form.* Characteristic giant cells are found in connective tissue which is infiltrated with round cells. Beneath the cervical epithelium are muscle bundles surrounding small islands of embryonic connective tissue in the center of which are giant cells and epithelioid cells. These frequently follow the course of the vessels.

*Interstitial form.* The microscopic anatomy is not very definite. Calcified sections show muscular fibers then a zone of embryonic cells and then a zone completely necrosed. The embryonic cells tend to form rounded nodules within which are giant cells.

*Vegetating or papillary form.* Some cases begin as tubercular catarrhal endocervicitis extending to gland structures causing hypertrophy and hyperplasia of gland cells. In other cases the gland cells are little changed the tubercular process being limited to the stroma tissue.

*Ulcerative form.* Microscopically this form is never found alone. In the submucous tissue or even in the muscular fibers in the region of the lesion there is a cellular infiltration in which tubercles are located and which always extends farther than the dimensions of the ulcer would lead one to suppose. The glands and papules are sometimes covered with two or three thicknesses of epithelium. The glands are numerous or regular dilated and filled in some cases with leucocytes. The epithelial proliferation does not invade the interglandular tissue as in epithelioma where the membranes of the glands are broken.

The subjective symptoms of tuberculosis of the cervix are rather vague and indefinite. Since in the majority of cases there is

involvement of the uterus tube or ovary symptom when present are frequently referable to the organ. Moderate indefinite pain in the lower abdomen a sense of weight in the pelvis and aural discharge are occasionally complained of according to Beyer. In most cases the general condition is good feeling healthy rarely can except in patient with extensive procreant elsewhere in the body. Fever is a rare symptom. Amenorrhea which has been noticed by some however is a constant symptom was found by Murphy in six out of nine but in the three remaining in mild and in two profuse. The menstrual symptoms are leukorrhea. In the early stage the discharge is light muco-purulent and in the later stage during the later stage is a purulent increase the discharge is more profuse purulent and very offensive. In rare cases tinged with blood slight bleeding after coitus is fairly frequent. Arrived in this which bring the patient to examination. In the very late stage there may be considerable blood in the discharge but the differ from the watery blood stained discharge of carcinoma is a purulent infection.

Finally the diagnosis is in all difficult. All type and type with discrete resemble carcinoma. Of course reported by Beyer 14 were diagnosed more than said tuberculous of the cervix but all the objective symptoms of carcinoma. The history is important. History the chronic nature of the disease and often tuberculous elsewhere in the body. Age is important in differentiating tuberculous lesion from cancer of the cervix. Tuberculosis occurs most frequently during the period of sexual activity while cancer occurs in patient past middle life. In an analysis of 57 patients Beyer found 6 to be between sixteen and twenty six years 7 between twenty one and thirty 9 between thirty one and forty 5 between forty one and fifty 3 between fifty one and sixty 3 between sixty one and eighty and 3 between eighty one and seventy nine.

The appearance of the discharge is important. In the early stages it is a glairy mucus later becoming frank pus or streaked

with blood especially after coitus or examination. The differs markedly from the blood stained crum of carcinoma.

In which is a characteristic symptom of carcinoma has been mentioned a slight involvement in tuberculosis. The general condition of the patient is important. In cancer there is a progressive loss of weight and strength with the advance of the growth. Tuberculosis of the cervix may exist a long time with but light constitutional symptoms unless in a very procreant elsewhere in the body.

On examination the appearance of the cervix is in all different though not characteristic. As the disease begins in many cases in the canal and extend downward the cervix becomes enlarged and pituitous admitting the examining finger. The diseased tissue is soft and velvety to the touch not friable as in carcinoma bleeding is highly manipulable much less than in carcinoma. Induration and induration of surrounding tissue is usually slight. Beyer states that in most cases there is more than in epithelioma the vaginal portion of the cervix but never as much as in adenocarcinoma. In the advanced case mobility of the uterus is diminished against carcinoma is enlarged and the tube. The frequency of involvement of the tube in cervical tuberculous has already been mentioned.

Simple erosion of the cervix and cervical herpes are to be distinguished. Herpes usually occur in multiple lesion circular with red base and they are secondarily infected. Primary lesion is one ulcer and gummatous often with tuberculous but are usually readily diagnosed by the Wassermann test.

There is such a similarity to cancer in nearly every form of tuberculous of the cervix that a specimen for microscopical study should be taken in every case. And owing to the similarity in microscopical appearance it will be necessary to resort to guinea pig inoculation and the virulence test in certain cases. The coexistence of carcinoma and tuberculous which has been reported by several authors should not be forgotten.

The treatment should be directed toward a

complete eradication of the disease. Medicine and hygienic treatment are of little avail. Two methods, conservative and radical, are advocated. The conservative method, amputation of the cervix, preferably with a cautery or cauterization of infected areas in the cervix, followed by the application of caustics such as zinc chloride or caustic potash or antiseptics, is advised by Hegar, Fournier, Murphy, Martin, Beyca and others. The curette should be avoided owing to the danger of disseminating the infection. The radical method of treatment, panhysterectomy by the abdominal or vaginal route, is endorsed by Pozzi, Lewers, Emmanuel, Frank, Kynoch and others.

In the choice of a method of treatment, each case must be considered individually. Pozzi's advice, that given a case of circumscribed ulceration of the cervix without tuberculosis elsewhere, we should have no hesitation in doing a panhysterectomy, should be accepted with reservations. The question of depriving a woman of the possibility of childbearing must be considered. Professor Tedenit cited by Martin reported a case of a primary tubercular lesion of the cervix treated by cauterization, after which the patient became pregnant and gave birth to a living child. On the other hand, the employment of conservative methods of treatment when the cervix is extensively involved, reserving radical treatment for recurrence of the process, is a questionable procedure. Cornil, Veyrat, Martin and many others have shown histologically that the macroscopic involvement of the cervical canal or the vaginal portion of the cervix is not an indication of the extent of the process. Many cases which show only a slight external lesion, on section of the cervix are found to have an extension of the process deep among the muscle bundles. As will be shown by the report of my case, enlargement of the tubes and uterus does not exist in all cases where these organs are involved.

Beyca's report of fifteen cases treated surgically gives us some idea of the results to be expected following the different methods of treatment. In ten cases panhysterectomy was done; in one the uterus was curetted, the cervix amputated and a double salpingo-

ophorectomy done; in four the cervix was amputated. Three of the patients upon whom panhysterectomy was done died from shock, phthisis or tubercular peritonitis of the remaining seven; six were well five and one half years after operation. The patient who was curetted, whose cervix was amputated and upon whom salpingo-oophorectomy was done, recovered. The other four are not mentioned. He also reported eleven patients treated with local applications; one was said to have recovered, five were temporarily relieved and in five the disease progressed. Murphy stated that in cases where the cervix alone is involved, amputation of the cervix is sufficient. As the mortality from panhysterectomy is 30 per cent, he warns against this method except in rare instances. He advises curetting and cauterizing with 30 per cent zinc chloride for thirty-six hours and if the disease returns, excision of the involved area. The danger of this procedure would seem to be that a recurrence of a tubercular process often indicates an extension to other structures.

The final decision of the method of treatment in a given case should be made only after a careful consideration of the patient's general condition. If there is an active process elsewhere in the body, excision of the local process will be of no benefit. Second, the question of childbearing must be given consideration in certain cases. If the patient desires to have children and the general physical condition will permit it, a conservative operation should be done provided the uterus and tubes are not extensively involved. If for any reason the question of childbearing is not to be considered, panhysterectomy should be done whenever there is reason to believe that the uterus or tubes are involved. There are certain cases in which the tubercular lesion in other parts of the body is healed or dormant and the lesion in the cervix is progressing when a conservative or even a radical operation may be indicated. This can be decided only after careful study.

The prognosis depends entirely upon whether there are active lesions in other parts of the body and on the complete eradication of the disease.





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## CHOICE OF METHOD IN OPERATIONS UPON THE PITUITARY BODY

By CHARLES H. FRAZIER, M.D., Sc.D., F.A.C.S., PHILADELPHIA

**D**URING the past ten years partly as a result of investigative inquiry into the physiological properties of the pituitary body partly and to a greater measure as a result of the direct observations of the anatomical lesions on the operating table in the living subject the practical problems of pituitary disease have been illuminated. There is no longer the uncertainty that once prevailed as to the management of these cases and there is slowly evolving some sort of order out of the earlier period of chaos. While to be sure the surgery of the pituitary body is still in its developmental stage we now have at hand in abundance of facts physiological pathological and clinical which serve as a foundation upon which the surgeon may construct his therapeutics.

The life history of the pituitary tumor is a matter of no small significance. Let me remind you that in its pathological deviations the pituitary is not unlike the thyroid gland. As with the thyroid so with the pituitary the most common lesion is the adenoma in both instances often with cystic developments. It is within the limits of a reasonable estimate to say that 75 per cent of pituitary tumors may be classified as adenomata. In fact the more minutely specimens are examined and the greater the experience of the examiner the smaller is the percentage of malignant growths. While pituitary lesions at best

present many grave aspects the absolute benignity of the underlying process in the majority of instances detracts somewhat from an otherwise serious situation. In other words it means can be devised to prevent the recurrence of local or general intracranial pressure the life and comfort of the patient may be assured for many years.

As a result of our larger and longer experience in dealing with pituitary disorders we have been able to formulate with greater precision the conditions under which surgical therapy is to be recommended. The symptoms of pituitary disorders which must be reckoned with are (1) those due to general intracranial pressure such as headache (2) those due to involvement of the optic chiasm and tract—the ocular phenomena (3) those due to involvement of neighborhood structures and (4) those due to secretory derangement. As yet I have had no cases under my care where justification for the risks entailed in operation were furnished by the secretory disorders such as acromegaly or the Froehlich syndrome or by neighborhood symptoms so that in large measure the surgeon is asked to intervene for one of two conditions either distressing headache or vomiting or failing vision and in the final analysis it is threatened vision which in the mind of the patient provides the imperative demand for relief. Unfortunately in the majority of



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patient who have a unilateral pupillary physical already further advanced that retinal detachment is out of the question.

With the introductory remarks we are



1. The first group of people who are interested in the results of the study are the researchers themselves. They want to know how well the study was conducted and whether the results are reliable and valid. They also want to know how the study was funded and whether there were any conflicts of interest.

prepared to discuss the main issue of the paper: the choice of method in the approach to the pituitary. While numerous routes have been utilized with the same object in view,

me of them through the cranium, other through the facial architecture, time and experience have eliminated all but two—the submaxillary (optical) approach (Hirsch-Cushing) and the author's front-orbital method. It seems to me the fundamental principles upon which I constructed the method of approach to my region or gland are first safety, predictability, and amplitude of exposure, and third, end result. With the basic principle as a guide, let us analyze the individual merit of the two radically different and distinct methods of approach to the chiasmata and first with regard to safety. In a series of various methods called by Cushing the mortality of the submaxillary (optical) method was limited at 9 per cent and the front-orbital at 8.6 per

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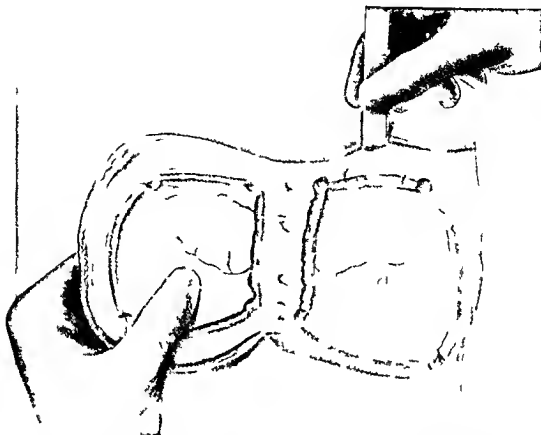
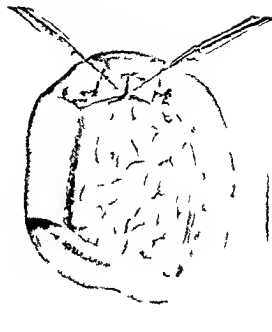
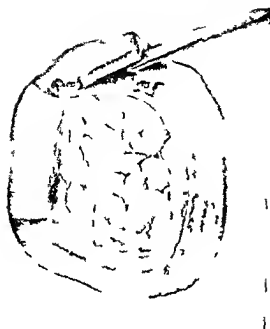


Fig. 4. Plating of the orbit. The dotted line represents the lines through which the upper orbital rim and part of the orbit are retracted.

cent. Adding to this collection 8 unreported fronto-orbital operations without a death the mortality of this method is reduced to 6.4 per cent. If I add to this series one case in which this method was used for the removal of a tumor of the optic nerve causing pituitary symptom the mortality rate is raised to 9.6 per cent. It is quite evident therefore that from the standpoint of mortality rate the two methods of approach compare favorably with one another. I believe however that in the course of time as the surgeon becomes more familiar with the various steps of the operation the cranial method will prove to be the safer if only for one reason. By the endonasal route meningitis must always be reckoned with and as a matter of fact has been responsible for the majority of fatal cases. One can never have the assurance in the endonasal route that the sphenoid sinuses are even in healthy subjects free from contaminating organisms. Two of the three deaths in my clinic following the endonasal operation were due to meningitis.

In the fronto-orbital operation the approach to the sella may be made without invading a contaminated field provided one avoid the frontal sinus and in this cranial approach to the sella turcica the surgeon has no more concern about meningitis as a complication than he has in the exploration of any other cranial structure by the osteoplastic method. There have been no fatalities in my clinic for operations upon pituitary lesions by this frontal method and one death in the attempted removal of an orbital nerve tumor which though causing pituitary disorders was distinctly an extrasellar lesion. In this case a furious hemorrhage occurred which was attributed to the rupture of the internal carotid artery the walls of which had been eroded by the tumor. When the intracranial pressure was relieved the wall of the artery gave way. The details of this the only fatal case in my series are mentioned because the outcome reflects in no way upon the merits of the operation and could not be charged to any technical step peculiar to the operation.



It is a well-known fact that the pituitary gland is situated in the sella turcica of the sphenoid bone, and is surrounded by the sphenoid sinus. The gland is approximately 1 cm. in diameter and is connected to the hypothalamus by the infundibular stalk. The gland is the source of the anterior pituitary hormones, which are secreted into the anterior pituitary gland.

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When I first made the incision, I was a little bit nervous, but I have since gained confidence in the light of the experience. The first of the technique involve incision, entirely, I mean to the upper lip, experience from beginning to end, the field of operation is cramped, no matter how much light is used, and it is not a very good view, but it is a satisfactory view. It is quite natural that it should fall to the lot of a nasal procedure. For the first time, the end of the method. Accustomed to be at the technique of subnasal incision and to position upon the phenoloid incision, it was but one step farther to remove the roof of the sinus and open the sphenoid.

Continuing our study of the two operative plan, cranial and nasal, let us consider them from the viewpoint of simplicity of exposure. There is no doubt that when the pituitary lesion is primarily and exclusively intracellar and at the time of operation is not extended beyond its bound, the lesion may be dealt with satisfactorily by the nasal approach. In the category of

example will be many cases of acromegaly where the enlargement is more or less uniformly increased in all dimensions depending somewhat upon the size and shape of the underlying phenoloid sinus. But few if any operations are performed for acromegaly alone. The primary indication for the incision of the sphenoid is to reach the tumor in many instances simple extra cellular extension. In other words, a pituitary lesion entirely intracellar is not sufficient to cause optic atrophy and certainly not the sign of increased intracranial tension. The presence of either of these is best usually in extra cellular extension and it may be that should be recognized as a strong argument in favor of the frontal approach. I have had an opportunity on successive occasions of comparing the advantage of incision of a pituitary lesion from the endonasal and frontal orbital approaches. In one of the cases the symptoms of pituitary disorder were unmistakable, the vision in both eyes increased in size of fundus and field, pain of the teeth in the inferior maxilla, sexual impotence.

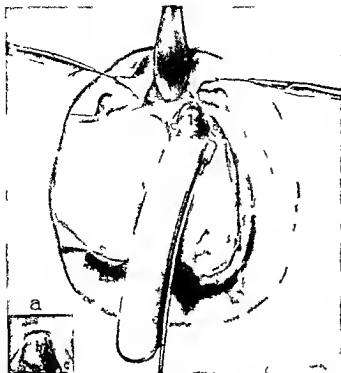


Fig 7 The contents of the orbit are displaced backward the frontal lobe protected with gauze is elevated and the pituitary tumor *b* is freely exposed between the optic tracts and *c*

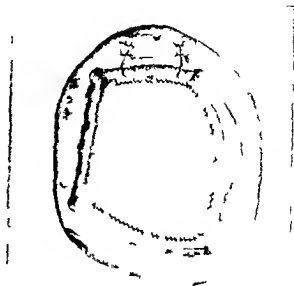


Fig 8 The tumor is being held in place with a curved needle

well defined changes in the eye grounds and a roentgenogram rather characteristic of an intrasellar growth. At the operation by the endonasal method a strawberry like mass protruded once the sellar floor was removed. When however its fragmentary removal was begun constant oozing prevented a satisfactory view and on the whole it was quite impossible to estimate the size and extent of the lesion. Following a period of relief of two years duration there was a return of visual deterioration and the patient presented himself again for treatment. At this time I exposed the sella by the frontal method and the readiness with which the contents of the sella could be seen and the ease with which the adenoma was removed were in striking contrast to the only too imperfect view of the first operation. It was a convincing demonstration of the relative merits of the two operations.

In this discussion the question comes to mind at once is it possible before the operation to determine the extent of the lesion. Were this possible let us admit for the sake of argument the advantage of the endonasal

route for lesions strictly confined to the sella. As a matter of fact however it is impossible in many instances to determine by roentgenogram or symptoms how far the lesion may have extended beyond the sella or whether it ever began there. While there are pretty definite lines of distinction in the roentgenogram between a primarily intrasellar and an extrasellar lesion there are many exceptions. I can recall in my own series for example the case of a man aged 61 years who had symptoms of hyperfunction of the anterior lobe. The clinical picture was typical the X ray findings characteristic of an intrasellar lesion. Had I chosen in this case to approach the lesion by the endonasal route I would have overlooked altogether an endothelioma the size of a plum taking its origin from structures in front of the pituitary. This tumor was unquestionably the primary lesion the symptoms of pituitary disorder secondary. Other examples of extrasellar lesions discovered only at operation by the frontal method I might cite to emphasize this point. Even though we exclude these strictly extrasellar lesions and confine our consideration to primarily intrasellar lesions is it possible except by conjecture or speculation to say



but the position which the tumor extends beyond the limit of the skull in the direction of the growth may be ascertained in the following manner. It is a common fact that very few cases of intracranial tumor have a considerable extension beyond the limit of the skull. The growth of the tumor is usually confined to the intracranial space, and the tumor is usually found to be situated within the skull. The growth of the tumor is usually confined to the intracranial space, and the tumor is usually found to be situated within the skull. The growth of the tumor is usually confined to the intracranial space, and the tumor is usually found to be situated within the skull.

Still another factor which should influence us in the choice of method is the condition of the sphenoid sinus. By the endocranial method the improvement which follows is in part due to the relief of pressure. When the sphenoid sinus is large and not encroached

upon the opportunity for expansion of the tumor is lost. It is a common fact that very few cases of intracranial tumor have a considerable extension beyond the limit of the skull. The growth of the tumor is usually confined to the intracranial space, and the tumor is usually found to be situated within the skull.

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Let us now turn the question now from a rather smaller angle. I have in mind the management of pituitary cyst. About 10 per cent of the men develop cyst. The cyst may extend well beyond the confines of the sella. In some cases it may extend to the level of the pituitary and its dimensions could only be determined by an intracranial operation. More evacuation by puncture is of only temporary benefit. The cyst soon fills up again. Matter by what method the cyst is approached. Many instances have been recorded of this sequence of events. Hence it is incumbent upon the operator

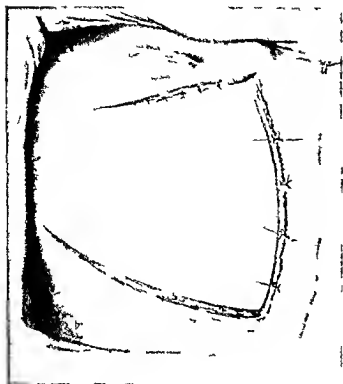


Fig 11 The flap is replaced and the initial sutures through the aponeurotic layer are in place

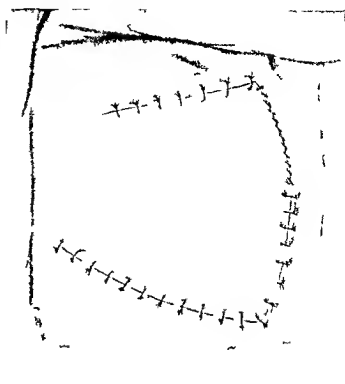


Fig 12 The final closure of the cutaneous margin with interrupted sutures with the exception of that portion of the incision between the root of the nose and the hair line which is more carefully approximated with a No. 00 silk continuous epidermal suture

should he anticipate more than transitory results to remove a portion of the cyst wall and this can be done effectively only by such exposure of the cyst as one would obtain by the direct suprasellar approach. Curiously enough the first case upon which the fronto-orbital route was employed in my clinic happened to be a pituitary cyst. A young man in his twenty third year for at least five years prior to his entrance to my clinic had symptoms of pituitary derangement but it was not until he began to have signs of increased intracranial pressure and was almost blind that he traveled across the Continent for relief. The cyst was really an intracranial affair and wholly beyond the limitations of an operation designed for an intrasellar lesion.

There is another restriction to the endonasal method that should be mentioned namely the undeveloped sinuses in children. When the sinuses are of the presphenoidal type the adoption of this method would be hardly justifiable.

The last and third test by which I have attempted to weigh the relative merits of the

two procedures under discussion is the end results. This in time should be the acid test of all operative procedures but in this field of surgery sufficient time has not elapsed to apply it. Case reports have not included end results and the records of recurrences and the records of improvement after operation in months or years are not available in sufficient numbers to enable one to make accurate and reliable deductions. To be sure recurrence of symptoms no matter what the method will be frequent and necessarily so because the contents of the sella cannot be emptied completely for obvious reasons.

Furthermore comparison is difficult because of the wide dissimilarity between individual cases some of them are at a comparatively early stage in the history of the lesion others in the terminal stage with large extrasellar extensions some adenomata others carcinomata or sarcomata some of them primarily intrasellar others primarily extrasellar. To quote from another's opinion of the advantages of the fronto-orbital over the



endonasal method the writer says that though it is not possible yet to decide finally between these the opinion can be expressed that the fronto orbital route is more suitable in the majority of cases.

With this we will conclude the discussion and refer briefly to the essential features of the operation under consideration. The fronto orbital route a modification in turn of McArthur's operation is the successor of a number of cranial routes the first of which through the temporal fossa we owe to Horsley who performed his operation as early as 1904. From that time on a number of plans for reaching the sella were proposed mostly transphenoidal such as the plans of Schlosser, Cushing, Hirsch, Kanavel, Halsted and others but in 1911 an effort was made to find a safe and reasonable route in a direct route resulting in the fronto orbital method. When first proposed it involved a reflection of an osteoplastic flap from the frontal region the temporary resection of the supra orbital ridge the removal of what remained of the roof of the orbit. With the head in the Trendelenburg position the orbital contents were displaced downward the frontal lobe elevated until the optic nerve was exposed and it emerged from the optic foramen. The sellar contents were brought into view by a horizontal incision in the dura a centimeter above the base of the skull. As originally described the operation gave a somewhat restricted view of the sellar contents and since then I have modified the technique to overcome this possible objection.

The essential difference between the two methods is that in the original the approach to the sella was extradural whereas as now practiced the approach is intradural. This modification introduces a T shaped incision in the dura with its horizontal limb on a level with the supra orbital ridge and the vertical limb extending down toward the sella turcica. By this slight change in technique the frontal lobe is elevated with greater facility and the view of the sella region very much more satisfactory. Furthermore the intradural route avoids the necessity of removing the roof of the orbit a rather tedious step in the original technique. Certain modifications of the osteoplastic flap have been proposed by others to avoid the necessity of the mid forehead incision but the cosmetic results in my own series following closure of the wound with epidermal suture have been so good and the advantages of reflecting the flap toward the temporal region are such that I hesitate to change.

In the constructive period of any field of surgery the pendulum of opinion swings from one view to another. My first introduction to pituitary surgery was through the frontal route. Later a number of my cases were operated upon by the transphenoidal method but its limitation soon became apparent and I returned with certain revision to my original technique. The surgeon dealing with pituitary lesions should be familiar with both methods but a time does on I believe the fronto orbital route will be found to have a wider field of application.

## THE SURGICAL TREATMENT AND PROGNOSIS OF EMPYEMA FOLLOWING LAGRIFFE

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**D**URING the past year we have had the opportunity of treating in our service 27 patients suffering from empyema the empyema in all but one case following la grippe. Of the 7 patients 8 died and 19 were cured or are recovering. The mortality percentage is therefore a little more than 30 per cent which is very high. How can we interpret this fact? When the patients arrived at the surgical service they were all suffering from dyspnoea and could be grouped into two classes: first those who were suffering from what might be called white dyspnoea and those suffering with blue dyspnoea. In the first group respirations were from 25 to 30 per minute, the volume depending on the amount of pleural pus. The patients were pale. The micro organisms producing the pleurisy were the following: 9 streptococci, 3 staphylococci, 5 pneumonia. In all of the cases operation relieved the dyspnoea and the temperature became normal within a few days.

In patients with blue dyspnoea the number of respirations was high, from 45 to 50 a minute, and there was cyanosis of the face and extremities. In these patients the dyspnoea did not vary according to the amount of fluid in the pleural cavity, as a rule the empyema was not extensive. This is not the case in the usual pulmonary diseases (pneumonia, splenopneumonia, bronchopneumonia) where there is congestion or oedema very often of both lungs. In these patients the operation did not produce a change in temperature and the dyspnoea was even aggravated due to the artificial pneumothorax, a factor which surely helps to lessen haemostasis which is already very deficient owing to the pulmonary condition. These patients died from 24 to 48 hours after operation.

Their pleural symptoms appeared as follows. In Case 1 8 days after the beginning of the grippe with operation on the ninth day. In Case 2 5 days after the beginning of the grippe with operation the same day. In Case 4 6 days after the beginning of the grippe. In Case 5 3 days after the beginning of the grippe with operation the same day. In Case 6 9 days after the beginning of the grippe with operation the same day. In Case 7 5 days after the beginning of the grippe with operation the same day. In Case 8 7 days after the beginning of the grippe no operation being done because of the poor condition of the patient. In Case 9 the date of commencement of pleural symptoms was not known but the patient was admitted to the service on October 6 and was operated upon the next day.

The micro organisms causing the symptoms in these cases were: 1 staphylococci, pneumococci, 3 streptococci. This shows that neither the micro organism nor the precaution of operation changed the prognosis in regard to the empyema. The prognosis is dependent upon the condition of both lungs. If the function of the lungs is already impaired owing to previous disease operation aggravates the condition instead of relieving it. The 19 cases cured were operated upon after the pulmonary symptoms had subsided or were about cured. The 8 patients who died were operated upon while the pulmonary disturbance was present. Are we justified in saying that if we had postponed operation in our fatal cases our patients would have lived? Surely we recognize the seriousness of pulmonary disease which alone may cause death without pleural complications. We would like to say that the only chance of cure in these patients lay in postponing operation as

long as the pulmonary conditions were serious. In support of our theory we have the fact that the number of respirations is higher after operation than before. We cannot attribute this finding to operative shock as we operated upon the patients under local anesthesia (10 to 20 cubic centimeters of 1 per cent novocaine). The time required to do a simple pleurotomy was only 10 to 15 minutes. As we will show in describing our technique we took every precaution to prevent pulmonary complications. Case 18 which is described below shows the advantage of postponing operation while pulmonary symptoms are in progress.

Soldier C, age 22, arrived at the medical service of Dr. T. J. McLaughlin with pulmonary complications marked by dyspnea and symptoms of pleural congestion on the right. On July 10 examination revealed illness of the right lobe of the left lung, breath sound vesicular, dullness, hyperphonia or bronchophony. Twenty cubic centimeters of a liquid of dulcified chloroform was injected. On July 11, patient was seen again. Four hundred and fifty cubic centimeters of fluid was removed, forming a thin rind. On July 12 symptoms of hepatitis of the right lung were manifest and the patient spent the month of July at the hospital. He was treated by aspiration and drainage of the right lung, injection of specific serums. On August 1, after the beginning of his illness, the patient was sent to the surgical service. At that time he had what we term hite dyspnea and his pulmonary symptoms had subsided. At operation no organisms of foul smell; *g. pus* (*streptococcus*) were evacuated after which the dyspnea improved and the temperature fell to normal. He died.

It is not possible for us to state that Soldier C would have died if he had been operated on at the beginning of his pleural symptoms while the pulmonary disturbances were still in evidence, just as it is not possible to say that our other eight patients would have been cured if we had postponed operation.

#### TREATMENT

From a careful examination of our cases we have arrived at certain conclusions as to the operation itself and as to postponed treatment. The first 5 cases of empyema followed the grippe. We believe that the empyema in these cases was of a special character both as to the clinical evolution and in regard to treatment. As we have

stated, pleurisy is a complication of the grippe and appears at different stages of the disease. When it appears as in Cases 1 to 9 inclusive and in Case 4 at the beginning of the grippe the prognosis is extremely serious. In all our cases only one Case 24 survived. That he lived was due to the fact that he was an American soldier stronger than the other soldiers and not weakened by the great hardships which many of our patients had suffered due to the fact that they were boys from the last recruited class and were weakened by very hard work. It is also true that in Case 4 the right lung was in good condition.

In our opinion the particular kind of micro-organism which causes the pleurisy, contrary to the classic opinion, has no bearing on the indications for operation and on the method of performing it.

We have used the operative technique as practiced by Marion Piquet Legara and Charles Lemonant. We have resected the ninth rib sixteen times, the eighth rib three times, the tenth rib once and two ribs once, the eighth and ninth. We have had no complication and postmortem examination of our fatal cases has shown that drainage was effected in the correct place. Cure in 18 cases is also proof of the advantage of such resection. We have found it advantageous to make a posterior or backward incision as has been recommended by Walter and Pringle. After operation the patient can lie upon his back without pain or inconvenience. Our experience leads us to doubt the advantages of the Hutton technique as recommended by Dr. Cost. Hutton believes that the pleural cavity is not drained by gravity but by inspiration. He recommends cutting the sixth rib in the axillary line as he thinks at this level the lung is not so retracted and therefore the pus is more readily evacuated by inspiration.

Our technique may be described as follows. A four inch incision is made one inch below the angle of the scapula. The external extremity of the incision is at the level of this scapular angle, the internal 10 centimeters inward. We do not cut the skin exactly under the rib but a little below. After resection of the rib which is done following the classic

indications by tying the intercostal vessels we make a very small incision into the pleura so as to let the pus run slowly. At this moment we stop the anesthetic and after the pleural cavity has been emptied we enlarge the opening at the end of which we attach a compress. We break the adhesions and remove the thick pus which will block the drains as it is too thick to run as we have found by examination at autopsy in our fatal cases. We now cut in a perpendicular direction in the middle of our first incision the skin and muscles to a length of one and one half inches so that we have a T shaped incision in the vertical branch of which we put the two big drains. We sew up the transverse incision and fix the drains to the skin. Besides producing better results from an esthetic point of view the T incision we have noticed prevents the formation of a fistula.

We use one long and one short drainage tube. We clean the field with ether and place a large pad of cotton on the wound. It seems to us that there is no doubt that simple pleurotomy without rib resection in the treatment of empyema is insufficient. In seven cases where we followed such a method the first four cases 2, 4, 5 and 7 showed at postmortem examination the presence of adhesions and thick pus impossible to eliminate by means of such a method. In these four cases we did a simple pleurotomy because the patient was unable to undergo further treatment. Cases 10, 22 and 25 were patients in good condition and the bacteriological examination showed the pneumococci as the pus producing micro organisms in the pleurisy. In these three cases we were obliged to resect one rib 14 days, 8 days and 24 days respectively after the first operation and it was due only to the fact that the resection afforded a larger opening than the patients owed their recovery.

#### POSTOPERATIVE TREATMENT

On five of our patients we have tried disinfecting the pleura by means of hypochlorite of soda solution irrigating the empyema cavities with Dakin solution through Carrel tubes of different lengths extending in dif-

ferent directions using the technique of Professor Tuffier. We have not noticed any advantage from this treatment. As a matter of fact in studying carefully our Cases 11, 13, 25 and 26 we have found that only one Case 13 an American soldier who had a pneumococcal pleurisy has had no complications while being treated. He stayed in the hospital 56 days in order to leave absolutely cured. Case 11 a streptococcal pleurisy stayed in the hospital 68 days and had to be operated upon again to secure better drainage. Case 1 absolutely contra indicates the benefits to be gained with the Carrel treatment when there is a communication between the pleura and bronchial tree. The Dakin solution was the cause of coughing and suffocation. In Case 25 we changed the irrigation 20 days after we began using it because during that period the temperature did not become normal. The patient stayed in the hospital 84 days. Case 26 the first patient upon whom we tried this treatment has been in the hospital 139 days and had to be operated upon three times to enlarge the wound.

It is true that with such a small number of cases we are not justified in saying that this method is definitely contra indicated in the treatment of pleurisy but the results in using the Carrel Dakin method cannot be compared with those obtained in treating the patients with simple drainage of the pleural cavity. On the other hand it must be said that the Carrel treatment is more difficult and requires a particularly well trained staff.

We have tried the hypertonic salt solution in two cases. The first case is not mentioned in our case reports as it was a case of pleurisy following a bullet wound. We have had very good results with irrigation with Wright's solution through Carrel tubes. In the other case pneumococcal pleurisy we did not secure satisfactory results.

Of the 13 cases treated by simple drainage the patient who was cured in the shortest time was Case 10 who stayed in the hospital 44 days. Case 12 was in the hospital the longest time 99 days. This was a case of interlobar pleurisy with bronchial communication.

In concluding we wish to emphasize the importance of the necessity of using extreme care in applying the dressings as it is a well known fact that the pleura very easily is infected. We must avoid touching the wound with instruments that have not been thoroughly sterilized. The area surrounding the wound and the wound itself must be carefully cleansed with ether and large pads put over the drains and all held in place by a large band. The dressing must be changed once every day during the first 10 days at least. At the end of this time we begin gradually to diminish the size of the tubes continually shortening them until there ceases to be any drainage.

We use chloroform anaesthesia in operating upon our patients. We have not had any accidents from the anaesthetic as the amount of chloroform absorbed is too small. We require but five minutes to complete the operation. Before coming to the operating room the patients are given a quarter grain of morphine. For five or six days after operation we inject artificial serum and camphorated oil.

### CONCLUSIONS

1. The prognosis in empyema is not based upon the nature of the micro organism causing the condition but is based principally upon the condition of the lungs.

As pleurisy starts early with grippe we believe it is best for the patients to treat them medically by aspiration and injection of specific sera until the pulmonary symptoms have subsided. At this time surgical intervention has every chance of success.

3. The micro organism causing the pleurisy has no bearing on the type of operation to be performed.

4. In pleurisy developing late in a grippe the pleurotomy opening must be large extending backward. Resection of the rib is a necessity.

5. The classic treatment consisting in drainage without irrigation is the method of choice.

NOTE.—S. C. Thompson, M.D., St. Louis, Mo., held the case on the 11th of May, 1911, at the St. Louis, Mo., conference.

We have lost a patient (Franchis) who was operated on for empyema on May 16, 1911, at the St. Louis, Mo., conference.

CASE B. Age 43 had an attack of grippe from May 16. Between May 16 and 24 purulent pleurisy developed and on May 25 the patient was admitted to the surgical service. Bacteriological examination showed staphylococci and other microbial flora. The patient was operated upon May 27 a right pleurotomy with resection of the eighth rib being performed. The pleural cavity was found to contain about 300 cubic centimeters of fetid purulent fluid. The lobes were covered with false membrane. Several Carrel drains were put in and Dakin irrigations were administered every two hours. On May 28 there was a fetid odor from the dressing. Elimination of fetid sphacelous tissue blackish in color. Dyspnea increased on May 28 and on May 30 it continued to increase. There was cyanosis. The pulse was small and irregular. The patient died at 5:30 p.m.

1. A pocket or cyst of purulent pleurisy occupied the internal posterior side of the lung and the anterior portion of its two inferior lobes. The pocket emptied by empyema on the left of the eighth rib. The thickened walls were lined with false but membranes. The emptied pocket communicated with the lung on the left with the anterior side of the inferior lobe through a small opening. The left lung was free from infection. In the right lung a pneumonia and consolidation of inferior lobes were present. The presence of bronchopneumonia lesions with loculations (sac of pus) was verified.

CASE C. Age 10 had an attack of grippe from May 2 with purulent pleurisy developing between May 2 and 26. The patient was admitted to the surgical service on May 7. Bacteriological examination showed the pneumococcus. On May 10 a right pleurotomy was done without rib resection. The effusion of pus was evacuated. Cyanosis as present dyspnea was intense and the pulse small. There was no improvement after operation. The patient died May 31 at 3:30 p.m.

1. The pleural cavities right and left were filled with greenish pus. On the left with the ninth rib about 2 inches from the dorsal vertebrae. As seen the pleurotomy opening made two days before death. Wallinoff had taken place above the opening preventing the evacuation of pus. The entire inferior lobe of the left lung presented the usual appearance of ordinary lobar pneumonia at the moment of green hepatization. Only one third of the lower portion of the inferior lobe of the right lung was invaded by pneumonia. Congestion and emphysema of both superior and median lobes were seen. Purulent pneumonia was present throughout the serous membrane. Craniopneumonia the same as found in the pleura was present.

CASE 3. G. Age 9 had an attack of grippe on June 18 with purulent pleurisy. On June 19

He was admitted to the surgical service on June 10. Bacteriological examination showed the streptococci. Operation was performed on June 20 consisting in right pleurotomy with resection of the ninth rib. Three-fourths of a quart of pus was evacuated.

**Autopsy.** The right pleura was completely lined with thick pus and false membrane. In the right lung total splenization had taken place from summit to base, the three lobes were welded into one. Pus was found between the lobes. Edema and pulmonary congestion were present in the inferior lobe of the left lung.

**CASE 4.** F age 10 years had an attack of grippe dating from June 30 with purulent pleurisy developing between June 30 and July 6. He was admitted to the surgical service July 6. Bacteriological examination revealed streptococci. Operation consisting of right pleurotomy without rib resection was performed July 6. Following the operation the patient showed signs of asphyxia, well defined cyanosis was present and breathing was very labored. The patient was delirious, his pulse was small and irregular. Death occurred the same day.

**Autopsy.** One pint of purulent liquid was found in the right pleura, the thoracic walls were lined with false membrane and thick pus. There were a few adhesions on a level with the inferior one-third. From the left pleura there was a light serous discharge. In the right lung there were adhesions between the lobes, the lung was greatly retracted and the bronchopneumonia center was limited to one-third of the inferior lobe. In the left lung were slight adhesions with carnification of pulmonary tissues. Pericarditis, 200 grams of sero-purulent liquid found.

**CASE 5.** R age 10 years was taken ill with grippe on July 23 followed by purulent pleurisy between July 23 and 25. He was admitted to the surgical service on July 25. Bacteriological examination showed streptococci. Operation consisting in left pleurotomy with rib resection was performed July 26. After operation which was done under local anesthesia the wound became locally infected. The infection spread to the iliac region and was cauterized. The pulmonary symptoms did not improve after operation. The patient died August 11 at 5 p.m.

**Autopsy.** In the left pleura there were adhesions especially in the front on the back and sides. The pleura was lined throughout with false membrane and thick pus. The right pleura presented a roughened appearance. The left lung was retracted. Carnification of the entire lung trial by water positive. Congestion and edema were present in the right lung. Trial by water negative.

**CASE 6.** F age 42 years was stricken with grippe on August 5 followed by purulent pleurisy between August 5 and 15. The patient entered the surgical service August 14. Bacteriological examination showed streptococci. On August 14 operation consisting of left pleurotomy with rib resection of the ninth rib was performed. The general con-

dition of the patient was very bad. He suffered with intense dyspnea and asphyxia. About a quart of pus was discharged. He died August 14.

**Autopsy.** There was a small serous discharge from the right pleura. There were adhesions between the lobes of the right lung. The left pleura was lined with thick pus and false membrane. On a level with the lower third of the left pleural cavity a triangular pocket containing about 500 grams of serous liquid was found. Bronchopneumonia was present in the inferior lobe of the left lung.

**CASE 7.** B age 10 was stricken with grippe on September 5 followed by purulent pleurisy some time between September 15 and 20. He was admitted to the surgical service on September 30. Bacteriological examination revealed pneumococci. On September 21 right pleurotomy without rib resection was done. Pneumococcus bacilli were found in the blood culture. The patient died October 6.

**Autopsy.** Purulent pleurisy. The pleural cavity was partitioned vertically on a level with the axillary line with a discharge from the anterior portion that connected with the posterior pocket only through the top of the pleura. At the front a large quantity of pus was found while the posterior part was totally dry. The right lung was entirely hepatized. To the left was a discharge of about 8 grams of sanguineous liquid.

**CASE 8.** B age 6 years had an attack of grippe dating from September 26 with evidence of purulent pleurisy between September 26 and October 3. He was admitted to the surgical service October 7. No bacteriological examination was made. Because the patient was in such critical condition it was decided that an operation would be useless. The patient died October 8 at 8 p.m.

**Autopsy.** Large quantity of purulent liquid was found in both pleural cavities.

**CASE 9.** M age 20 years had been ill with grippe for an unknown length of time, purulent pleurisy manifesting itself on October 6. The patient was admitted to the surgical service on October 6. Bacteriological examination revealed the streptococci. On October 8 a right pleurotomy with resection of the ninth rib was done. On opening the pleura it was found that the right lung did not retract and that it had the consistency of cork. The patient died October 9.

**Autopsy.** False membranes — pneumonia at right base, bronchopneumonia of left base.

**CASE 10.** C was taken ill with grippe on May 9 complicated by purulent pleurisy probably about June 5. He was admitted to the surgical service on September 2. Bacteriological examination showed streptococci. Operation consisting in rib resection (eighth) and pleurotomy was done September 3. Two large drainage tubes were inserted but the cavity was not irrigated. On September 30 the tubes were removed. The patient left the hospital October 11, completely cured.

**CASE 11.** J age 2 was taken ill with grippe

May 9 with evidences of purulent pleurisy developed about June 26. On June 8 the patient was admitted to the surgical service. Bacteriologic examination revealed the streptococci. Operation consisting in right pleurotomy with resection of the eighth and ninth ribs was done June 9. When the pleura was opened 9 (1) rel drains were inserted in different directions. Irrigations were given every 4 hours. During the first three days there was a regular drop in temperature. On July 1 there was a rise in temperature morning 38 even 39. The patient was not able to get up until July 9. The patient was brought to the operating room and the cavity was drained of the fluid. The temperature dropped and the patient left the hospital cured on September 6.

CASE 12. Male age 30 had an attack of grippe commencing on May 3. The usual pleurisy manifestations between September 1 (and 2). The patient was admitted to the surgical service on June 26. Bacteriologic examination showed the presence of streptococci. Operation consisting in left pleurotomy with resection of the fifth rib was done June 9. There were symptoms of left interlobar pleurisy. Vibrations of the area of the subscapular region diminished but did not cease. From the thorax he could hear a sound of rubbing in the pleural extending up to the sinus line. On the axilla a line revealed a adenized zone very high up in the right pit. On June 9 two drainage tubes were inserted. The next day Dr. Kirkpatrick attempted to insert a needle paracostally on the right and then on the left. Irritations continued. Eight days later the erythema began to heal. Introduced gauze soaked in eucalypti oil. One month later the patient was discharged. On October 5 the patient left the hospital cured.

CASE 13. Male age 40 had an attack of grippe dating from March 4. The pleurisy manifested itself between April and May 14. He was admitted to the surgical service May 14. Bacteriologic examination showed pneumococci. Operation on May 15 consisting of pleurotomy of right lung with resection of the ninth rib. Four Carrel drains were placed in the pleural cavity. During the first ten days irrigations were given every 4 hours of Wright's hypertonic saline solution to percent. No change of temperature. Dr. Kirkpatrick substituted for saline solution and a large drainage tube was placed by the side of the Carrel drains. The temperature became normal after three days. On June 5 all drainage tubes were removed and the wound was closed. There were no complications and 60 days after operation the patient was declared completely cured.

CASE 14. Female suffered an attack of grippe during from June 1 complicated by purulent pleurisy.

On August 12. The patient was admitted to the surgical service on August 14. Bacteriologic examination revealed streptococci. Operation consisting in pleurotomy of left lung with resection of ninth rib was done August 4. Two large drainage tubes were put in. The day following the operation spontaneous emphysema developed extending to the left abdominal region and filling the femoral vessels down to the popliteal region. On September 10 the drains were removed and on October 15 the patient left the hospital completely cured.

CASE 15. Male age 20 suffered an attack of grippe during from June 1. The patient was admitted to the surgical service August 3. He was admitted to the surgical service August 14. Bacteriologic examination revealed streptococci. Operation consisting in left pleurotomy with resection of the ninth rib was done August 23. Two large drainage tubes were put in. The temperature became normal 3 days after operation. The patient was discharged on September 1. The drainage tubes were removed 5 days after which the patient was declared cured.

CASE 16. Male age 30 suffered an attack of grippe during from June 3. The patient was admitted to the surgical service July 9. Bacteriologic examination showed streptococci. Operation consisting in right pleurotomy with resection of the ninth rib was done July 4. An empyema was found. Two large drainage tubes were put in. These were removed August 8. The patient was discharged on August 15. The patient was discharged on August 15.

CASE 17. Male age 30 a teacher with grippe suffered an attack of pleurisy during from July 1. He was admitted to the surgical service on July 1. Bacteriologic examination showed streptococci. Operation consisting in left pleurotomy with resection of the eighth rib was done July 2. A large empyema was found. The patient was discharged on July 15. The patient was discharged on July 15.

CASE 18. Male age 19 suffered an attack of grippe during from July 1. The patient was admitted to the surgical service on July 1. Bacteriologic examination showed streptococci. Operation consisting in left pleurotomy with resection of the eighth rib was done. The patient was discharged on July 15. The patient was discharged on July 15.

CASE 19 C age 19 suffered in attack of grippe dating from July 8 followed by purulent pleurisy about July 15. On July 16 the patient was removed to the surgical service. Bacteriological examination revealed the staphylococci and other microbian flora. On July 17 a left pleurotomy with resection of the ninth rib was done. Two large drainage tubes were inserted. The temperature did not drop until about August 12. The drains were removed August 12.

The patient left the hospital cured October 5.

CASE 20 V age 31 suffered in attack of grippe about August 31 purulent pleurisy developing sometime between September 7 and 6. He was admitted to the surgical service on September 6. Bacteriological examination revealed pneumococci. On September 26 operation consisting in pleurotomy without rib resection was done. On October 11 the wound was again opened a pleurotomy with resection of the ninth rib being done. After the first simple pleurotomy the temperature dropped. On October 1 it rose and on October 6 the patient's temperature averaged 40 at night. On the 11th on resection of the rib false membranes were found also thick pus which could not be eliminated by a simple pleurotomy. The temperature dropped slowly on October 12 it became normal. The patient was discharged on December 5, cured.

CASE 21 T suffered in attack of grippe dating from August 31. Between September 20 and October 5 purulent pleurisy developed. On October 8 the patient was admitted to the surgical service. Bacteriological examination showed streptococci. On October 9 an operation consisting in left pleurotomy and resection of the ninth rib was done. After the operation a large flow of pus was noted. The temperature became normal October 10 and the patient improved nicely. The drains were removed October 5 and the patient was discharged November 20.

CASE 22 B age 10 suffered in attack of grippe dating from September 3. Purulent pleurisy developed between September 5 and 29. On September 29 the patient was admitted to the surgical service. Bacteriological examination revealed pneumococci. On September 29 an operation consisting in simple left pleurotomy was done and on October 7 resection of the ninth rib. As the temperature did not become normal after the simple pleurotomy on October 7 the ninth rib was resected. Large fibrous clots (about a glass full) which could not pass through the incision were found. No real pus was found. The patient was discharged cured December 10.

CASE 23 R on September 5 suffered an attack of grippe. Purulent pleurisy developed between September 25 and October 8. On October 8 the patient was admitted to the surgical service. Bacteriological examination revealed the streptococci. On October 9 operation consisting in right pleurotomy with resection of the ninth rib was

done October 5 an injection of antistreptococcus serum and another of antipneumococcus serum were given. October 9 operation was performed and about one quart of pus was evacuated and two large drainage tubes were inserted. Three days later local infection developed in the wound causing a rise in temperature. Treatment local application of Dakin compresses. October 17 temperature became normal and the patient began to convalesce.

CASE 4 K suffered an attack of grippe dating from October 5. On October 16 symptoms of purulent pleurisy developed. The patient was admitted to the surgical service on October 17. Varied microbian flora were revealed on bacteriological examination. On October 18 an operation consisting in left pleurotomy with resection of the ninth rib was done. After pleurotomy about one quart of fluid of doubtful character was evacuated. Incision T shaped. Patient convalescing satisfactorily.

CASE 5 M age 38 suffered an attack of grippe dating from November 9. Purulent pleurisy developed between December 7 and January 4. On January 7 the patient was admitted to the surgical service. Operation January 11 consisting in left pleurotomy with resection of the ninth rib. After operation there was an immediate drop in temperature. Daily irrigations of the pleura with Dakin solution were administered. At the end of six days there was another rise in temperature persisting for 10 days. Irrigations were discontinued. The temperature became normal. The patient recovered without the formation of fistula.

CASE 6 G age 0 did not have grippe and the time of the commencement of the purulent pleurisy symptoms was not known. On December 24 the patient was admitted to the surgical service. Pneumococci were shown by bacteriological examination. On December 24 an operation consisting in simple pleurotomy without rib resection was done and on January 19 pleurotomy with resection of the ninth rib was done.

After the first operation one large drainage tube was inserted. The temperature was about 38 and on the night of the tenth day it became 40. On January 19 a second operation was done consisting in resection of the ninth rib. Four Carrel drains were placed and through them every two hours Dakin irrigations were administered. On January 2 the temperature became normal. On February 1 there was a rise in temperature with oscillations. On February 14 the temperature rose to 39.80. On February 15 the original incision was enlarged. Next to the Carrel drain was placed a large drainage tube to allow discharge of liquids. The temperature became normal March 1 and the large drainage tube was removed. The temperature rose above normal on March 29. A drainage tube was again inserted and was kept in place until April 19. The patient was declared cured on May 13.



A STUDY OF BLADDER FUNCTION<sup>1</sup>

BY ARTHUR H. CURTIS, M.D., F.A.C.S., CHICAGO

**I**NCOMPLETE evacuation of urine from the kidneys or bladder is not infrequent and deserves more investigation<sup>1</sup> than has been accorded it. The present contribution is concerned with that phase of the subject which has to do with failure to empty the bladder and the complications which result therefrom.

In 1917 Besley strongly urged non-catheterization of the bladder in cases with injury to the spinal cord and asserted that he had never seen cystitis in a patient suffer from cord injury unless that patient had been catheterized. He stated further that he had never found evidence of disturbed kidney function as a result of allowing the bladder to become distended and overflow.

This expression of opinion by one whose judgment is to be greatly respected runs entirely counter to my experience. Whether we shall leave an ill-functioning bladder to right itself or shall assist nature through the use of a catheter is a problem of much importance; it concerns not only the bladder of the soldier with spinal injury but also many other conditions, notable among which is stasis of urine after operation.

In military service we made repeated attempts to test Besley's plan but someone unaware of our wishes always placed a catheter sooner or later. Recently in an experimental study of this subject rabbits have been used. These laboratory animals are in some respects more satisfactory than human patients particularly because they can be sacrificed at any desired time to determine just what changes have taken place.

**Material.** The bladders of twenty-two male rabbits were paralyzed by cutting the spinal cord. This injury produces a bladder paralysis entirely analogous to that which

occurs in soldiers consequent to gunshot injuries of the spine and cord.

The animals were housed in sanitary cages which permitted immediate drainage of voided urine. The buttocks and genitalia were kept clean through shaving aided by bathing and application of petrolatum many times daily.

**Results.** Bladder paralysis was obtained in every case to secure this a second operation was required in three instances.

Vesical distention was present in all except one rabbit which died three days after operation. The degree of distention was moderate in eight in the other thirteen cases the bladder filled the entire lower abdominal cavity. One rabbit without anatomical obstruction to urinary outflow died in consequence of spontaneous rupture of the bladder (Fig 1). Extensive vesical erosions or ulceration occurred in nine instances (Fig 2). Hemorrhages in the submucosa were frequent.

The ureters of four were not distended and those of three were doubtful whereas fifteen were unquestionably dilated some to an extreme degree (Fig 3). Of the dilated ureters both were involved eight times the left alone five times the right alone two times.

The kidneys were of much interest. Of the twenty-two cases seven were normal and fifteen pathological. The microscope revealed that seven had nephritis and six showed notable round cell infiltration (Fig 6). Intense congestion with more or less hemorrhage was frequent (Fig 7).

Nine presented marked dilatation of the tubules with which was often associated (in six cases) an extensive destruction of kidney substance. Despite the absence of anatomical obstruction to the outflow the ureter dilated the kidney pelvis distended and the kidney swells (Fig 3). The cut surface of such kidneys is streaked with coarse gray lines. Microscopically these gray lines prove to be veritable windrows of parenchymatous destruction characterized by atrophy and vacuolation of

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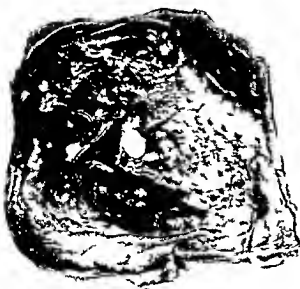


Fig. 1 Spontaneous rupture of bladder of rabbit consequent to vesical injury; there is no urethral obstruction. The rupture was a longitudinal slit one centimeter in length located in the right anterior wall of the fundus. Death from extravasation of urine into the peritoneal cavity.

cells (Figs. 4 and 5). The specimens which revealed this destruction were all from animals with considerable ureteral dilatation. These lesions were so intense as to impress me greatly with the serious damage which results from even temporary pressure upon the delicate kidney parenchyma.

*Bacteriology.* Infection was evident in

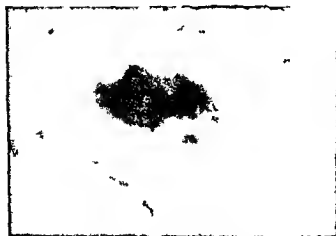


Fig. 2 Double large ulcer which developed on the anterior wall of a livid non-catheterized bladder. The floor of the ulcer was thick gray brown and microscopically seen to be densely infiltrated with polymorphous leucocytes. Note numerous small erosions elsewhere throughout mucosa.



Fig. 3 Dilated ureters and greatly distended kidneys. This photograph bears witness to the upper urinary tract when the bladder becomes overdistended and the catheter is withdrawn. It should be emphasized that back pressure of urine on ureter and kidney has been found regardless of the standing absence of obstruction to outflow from the bladder.

twelve of the twenty-two cases. Of these the mucosa of one ulcerated bladder was packed with polymorphous leucocytes but bacteria were not obtained. In the other eleven infected cases many bacteria were found in smears and cultures; one of them must be excluded from consideration because there was an associated beginning peritonitis. This leaves ten cases of undoubted urinary tract infection with numerous bacteria in every instance. Infection with three types of bacteria was encountered once double



Fig. 3. Culture of bacteria from a rabbit bladder. The culture shows a dense field of cocci, likely cocci, from a culture.

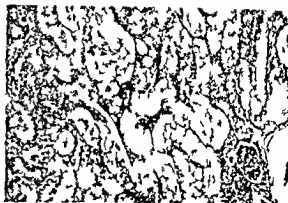


Fig. 4. Culture of bacteria from a rabbit bladder. The culture shows a dense field of cocci, likely cocci, from a culture.

bladder in a state of freedom from residual urine thus minimizing the danger of kidney involvement.

**Post operative bladder function.** Observation of surgical cases in military service has convinced me that postoperative retention in men is quite infrequent as compared with women. (Even an equal number of cases of retention in men and in women it is further probable that the latter develop a higher percentage of infection.) Except in instances of bladder paralysis or obstructed outflow the problem of vesical retention is therefore chiefly concerned with the female sex.

One year ago I reported a study of the female bladder during convalescence after gynecologic abdominal and vaginal operations. It was found that a special technique of the bladder is necessary after complete hysterectomy and during convalescence from prolapso operation. The size of the bladder for about one week frequently follows these operations probably due to partial destruction of the inferior vesical plexus.

Catheterization of these gynecologic patients was performed in approximately 5 per cent of the abdominal cases, in 25 per cent of the vaginal cases and in nearly 50 per cent of cases operated both abdominally and vaginally.

The catheter was used not only to alleviate pain but also whenever retention of the bladder was not spontaneously relieved.

Fig. 5. Culture of bacteria from a rabbit bladder. The culture shows a dense field of cocci, likely cocci, from a culture.

infection five times, and one kind of organism four times. Bacteria were isolated as follows: colon group bacilli from six cases, staphylococci from four, streptococci three, gram positive diplococci two, gram positive short bacilli one, gram positive large bacilli one.

**Summary.** A study of the effects of non-catheterization of the paralyzed bladder has been made in the case of twenty-two male rabbits. Extreme distention occurred thirteen times, with spontaneous rupture of the bladder in one instance. Nine showed extensive vesical erosions or ulceration. Back pressure with ureteral and kidney pelvical dilatation was usually present in cases that caused wide path of almost complete destruction of kidney tissue. Bacterial invasion of the urinary tract was demonstrable in ten of the twenty-two animals operated upon.

The present experiment upon rabbits indicates that the unrelieved paralyzed bladder offers a two-fold menace to health first through frequent infection of the urinary tract due to continuation of static urine and through back pressure which distends the ureters seriously interfere with kidney function and damages the kidney tissue. It would appear advisable therefore to mount in the paralyzed



Fig. 6 Cellular infiltration in kidney cortex. An evidence that avoidance of the catheter in cases with bladder paralysis does not eliminate the danger of infection.



Fig. 7 Distended kidney connection and hemorrhage. Another pressure injury the result of failure to relieve the overfilled bladder.

As a prophylactic measure a small amount of weak silver nitrate solution was instilled before withdrawal of the catheter. Most important of all every patient who resumed the power of spontaneous micturition after having been repeatedly catheterized was thereafter subjected to a daily test for residual urine until this was no longer present. It is better to dispense entirely with the catheter than to use it during too short a period of time or so irregularly that stagnant urine accumulates.

The above outlined method of after care of the bladder when conscientiously adhered to has yielded most gratifying results.

#### CONCLUSIONS

1. Failure to catheterize the paralysed bladder is followed (in rabbits at least) by

back pressure of urine which is exceedingly destructive to kidney tissue.

Associated urinary tract infection is frequent.

Irregularly performed catheterization for retention of urine is unsatisfactory. Patients so treated are subjected to such dangers as accompany the passage of the catheter and at the same time are rendered liable to accumulations of infected stagnant urine.

3. Carefully managed catheterization of the bladder which fails to empty spontaneously yields excellent results. The catheter should be regularly passed often enough to prevent vesical distention and its use must be persisted in until daily tests show that residual urine is no longer being retained in the bladder.

## NOTES ON VESICAL DIVERTICULA AND A MODIFIED TECHNIQUE OF SURGICAL ATTACK

## CASE REPORT

BY NATHANIEL P. LATHBURN, M.D., F.A.C.S., ET AL.

**D**IVERTICULA furnish one of the many interesting phases of bladder pathology which has been developed by the modern diagnostic method employed in urology. Previous to the development of the cystoscope these conditions were noted at autopsy and occasionally encountered in the course of operations performed upon the bladder for other conditions. Rich<sup>1</sup> indeed was it possible to make an accurate pre-operative diagnosis or to plan a definite surgical procedure which would effect a cure.

To illustrate the paucity of articles written upon this subject previous to the last decade Young<sup>2</sup> in an exhaustive review of the literature in 1906 could find only five cases reported in which an operation had been performed for the radical cure of bladder diverticulum. To this he was able to add three cases of his own. Since that time important contributions have been made by Chute,<sup>3</sup> Cabot,<sup>4</sup> Lower,<sup>5</sup> Squier,<sup>6</sup> Young and others. In the past year five cases have come under my observation. Three were subjected to radical excision by the method outlined in this paper; one declined operation at my hands and was operated upon by another Brooklyn surgeon; and one was treated by intravesical excision of the mucous lining as outlined by Young in a recent paper.

Some of the German writers early drew a sharp line between what they considered two definite types of this condition: the congenital and the acquired; the first group or true diverticula comprising those cases in which there can be demonstrated in the wall of the diverticulum all the coat of the bladder; the second group consisting of those cases whose wall were formed by mucous membrane only which had herniated through the muscular coat of the bladder. There is another type of so-called diverticula frequently seen in bladders which are hypertrophied as a result of

some obstructive lesion in the prostate or urethra. This is really nothing more than an exaggerated trabeculation. They are not true diverticula and their consideration and treatment is that of the underlying condition.

Bringing my opinion on a survey of the literature and my own personal experience I am disposed to believe that all true diverticula are congenital. Most of the cases when carefully questioned will give a history of some bladder irritability dating from infancy in which has been very much aggravated by an attack of acute cystitis with some well defined course of a chronic undischarged condition in which would predispose to infection.

In the absence of infection the symptoms would be very mild in character. With the addition of infection (and the colon bacillus is the usual offending organism) there develop a particularly severe type of cystitis with very foul urine. This of course is due to the residuum which is more or less constantly left in the sac. Diverticula of the bladder may be suspected in any case of intractable cystitis of long standing accompanied by very foul urine. Our suspicions are further confirmed if we can exclude any obstructive lesions or disease of the central nervous system which would ordinarily prevent the complete emptying of the bladder with the usual accompanying infection such as tight stricture, prostatic hypertrophy or tubes. We must bear in mind also that diverticula not infrequently are found co-existing with the following maladies:

Patients with this trouble present themselves with the usual symptoms of a severe chronic cystitis—frequency of urination, dysuria, nocturia and cloudy foul smelling urine. They will occasionally give a history of apparently emptying the bladder completely and directly after following some change of posture will again pass a considerable amount

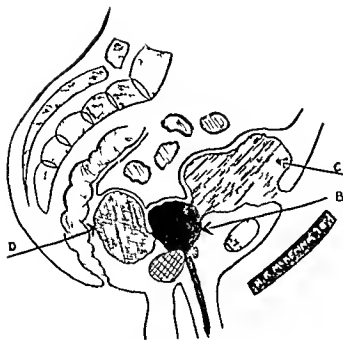


FIG. 1. Condition found at operation in author's case. B, Bladder; C, Catheter; D, Diverticulum.

of particularly foul urine. This symptom when accurately noted is strongly suggestive and is of course caused by the diverticulum emptying its contents into the bladder with the change of position. All of my cases have been subjected to a more or less prolonged course of internal medication and bladder washings; the attending physician evidently having contented himself with the very inadequate diagnosis of chronic cystitis. (One of my cases had a suprapubic cystostomy at the hands of a general surgeon without having a diagnosis made before or after operation.)

The diagnosis can usually be definitely and positively established by routine cystoscopy which is always indicated in such cases. One may note the location, size and shape of the orifice of the diverticulum and its size may be fairly well estimated by pressing into it a urethral catheter until it touches bottom. A more accurate estimation of the size, shape and location of the wall of the diverticulum may be obtained by the employment of cystography. For this purpose I have been using of late a 5 per cent solution of sodium bromide as recommended in a recent paper from the Mayo Clinic and find it very satisfactory. It is cheap, easily sterilized and

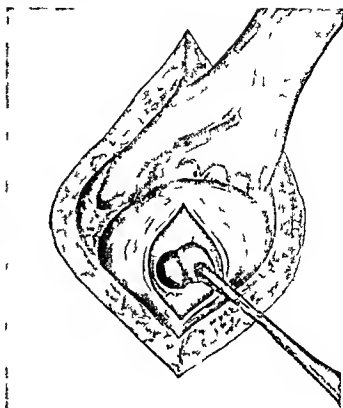


FIG. 2. Illustration of combined extra and intra-vesical manipulation.

gives a good picture. Cystograms should be made in two diameters and stereoscopically. In this way we can often get a clear picture of the diverticulum and its relation to adjacent structures which is of material help in the application of operative relief. Cystoscopy in these cases is sometimes very simple and sometimes quite the reverse owing to the difficulty of securing a clear medium in the badly infected bladder. It will often be necessary to employ a prolonged irrigation of the bladder with gallons of fluid before a satisfactory view can be obtained. In fact there are a few cases such as the one I am about to relate in some detail where it is absolutely impossible to perform a satisfactory cystoscopy. In this particular case several attempts were made with and without an anesthetic but in spite of copious irrigation large strings of tenacious mucus would stick to the bladder wall and the lens of the cystoscope in such a way as to minimize definitely the information obtained. In such cases we must rely upon other aids to diagnosis such as the symp-





Fig 4



Fig 5

Examination discloses a cachectic appearing individual. There are no evidences of any organic disease other than the lesion in the bladder. His suprapubic fistula is protected by a copious dressing in which is saturated with a mixture of pus, sloughing tissue and very foul urine. The operative wound is sloughing and surrounded by a red fluctuating area. The urine passed *per urethram* is milky and very foul. It is loaded with pus and culture shows bacillus coli. A catheter passes easily and there is apparently no residual urine. The bladder capacity is four ounces. Rectal examination discloses a prostate which is normal to the touch; the vesicles are not felt above the prostate; one notices a sense of resistance and slight tenderness. The patient was referred to the Brooklyn Hospital for further examination and treatment. Several cystoscopies made at intervals of three or four days were unsatisfactory because of the utter impossibility of securing a clear medium. A provisional diagnosis of diverticulum of the bladder was made and it was decided to perform a preliminary cystostomy for the purpose of temporarily relieving his symptom, overcoming in a measure the infection in and around the bladder and definitely establishing a diagnosis.

*Operation August 3, 1917.* Incision at the site of the previous operation opens at once into a large abscess cavity with sloughing necrotic walls. At the bottom of this cavity there is a small opening apparently into a pocket. Upon stretching the opening with the fingers there is a gush of pus and urine. At the bottom of this pocket there is another opening also admitting one finger which apparently passes directly into the bladder. When this latter opening is stretched several ounces of very putrid urine escapes. Upon further careful in-

vestigation it is discovered that what appears to be a pocket of an abscess cavity is really a much contracted bladder and that what appeared to be bladder is a large diverticulum. The condition noted is very well illustrated in Figure 1. It is to be noted that the diverticulum is considerably larger than the bladder which is much contracted. The necrotic material was cleared away so far as possible; the opening in the diverticulum was stretched to admit four fingers. A large rubber drainage tube was inserted in the diverticulum and anchored to the bladder wall; another tube was passed in the bladder through a median perineal section. The bladder was packed with iodoform gauze. Another iodoform gauze strip was placed in front of the bladder. No sutures were employed other than those used to anchor tubes to the bladder. The bladder and cavity of the diverticulum were irrigated daily with silver nitrate 1:1000. The perineal tube was removed on the third day; the suprapubic tube on the tenth day. The patient left the hospital on August 26, 1917, feeling much improved. There is still a slight leak from the suprapubic fistula which, however, is clean and evidently healing. The urine is still turbid but markedly improved. He was referred to his family physician with the suggestions that he be kept on urinary antiseptics by mouth and daily bladder irrigations.

*October 3, 1917.* The patient is very much better. The urine is turbid. There is still a little leak from sinus which was curetted.

*November 6, 1917.* The patient is much improved; sleeps all night and keeps dry. There is an occasional slight leak from the sinus. The urine is rather foul. Residue—five ounces. He is going South for the winter.

*May 3, 1918.* He has had a fairly comfortable





TRAUMATIC RUPTURE OF THE NORMAL SPLEEN<sup>1</sup>

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**S**UBCUTANEOUS traumatic rupture of the spleen is unusual without other serious injuries especially is this true if the spleen is not markedly enlarged or unduly movable. The four cases which I wish to report occurred in our service in a period of approximately three years. The first was on August 24, 1914, and the last October 7, 1917.

**CASE 1.** B. F. V., male, white, age 28 years, entered the hospital August 24, 1914, with a history of an abdominal injury.

The family and past histories were unimportant.

**Personal inspection.** In a runaway accident at night 24 hours before his admission the patient's horse suddenly turned and carried the vehicle up a two foot embankment. The patient was thrown against the dash board (the angle of which pressed sharply under the left costal arch) and out of the buggy. The wheels passed over him but he was not dragged. Although he suffered with dizziness and an agonizing pain in the left shoulder he regained his feet and stumbled around looking for his horse for a period of about 10 minutes. With the aid of a companion he walked about 1 mile to his home where he spent a most uncomfortable night owing to the agonizing pain in his shoulder which seemed to be accentuated in a recumbent position. He was thirsty, had profuse sweats and grew excessively weak during the night and as the day progressed these symptoms seemed to become worse. He was nauseated about 10 a.m. and vomited (vomitus contained no blood). His urine was very scanty and a catheterized specimen showed a small quantity of blood.

**Physical examination.** The patient was seen about 24 hours after the accident. At this time his temperature was 96°, pulse 94, regular and of small volume, respirations 34, short and superficial, and he complained of pain with each respiratory movement. He was pale and had a sharp, pinched expression about the face and nose. The lungs and heart were normal and there were no bruises on shoulders or thorax. The abdomen was slightly rigid and markedly tender and there was dullness in the left flank. There was no fracture of ribs or other bones.

Hæmoglobin 70 per cent, white blood count 26,100.

Urine straw color, cloudy, acid, specific gravity 1.0, 0 albumin plus sugar negative. Microscopic examination showed numerous pus and red cells, few granular and blood casts.

**Diagnosis.** abdominal hæmorrhage from ruptured spleen or liver.

**Operation.** Under cocaine anaesthesia 27 hours after injury a left rectus incision was made. On opening the peritoneal cavity a large amount of free blood was encountered. It was thought best to continue the operation under ether anaesthesia. The incision was rapidly enlarged and hand passed in the cavity, the spleen was examined and found to be enveloped in large blood clots. These were removed and there was active bleeding. An open rent was felt along the posterior convex surface extending the whole length of the spleen. Owing to the short pedicle we encountered considerable difficulty in making a proper ligation and removing the organ. The patient at this time was in considerable shock. Hypodermoclysis was started and a rapid closure of the wound was then made.

Shortly after operation the condition of the patient became so serious that it was thought best to use transfusion. The patient's mother acted as donor and blood was allowed to flow for a period of 15 minutes. Immediate improvement commenced with the introduction of fresh donor's blood into the vein.

The patient reacted well and made a fair convalescence. He was discharged from the hospital 5 weeks later.

**Blood findings.** August 27, leucocytes 10,600, hæmoglobin 0 per cent. Differential count: polymorphonuclears 82 per cent, lymphocytes 18 per cent.

September 1, hæmoglobin 65 per cent, total reds 4,800,000.

September 5, white blood count 35,000, polymorphonuclears 88 per cent.

September 11, total leucocytes 25,000, hæmoglobin 65 per cent, polymorphonuclears 86 per cent.

Urine August 26, amber color, cloudy, acid, specific gravity 1.022, albumin plus sugar negative. Microscopic: pus cells and red blood cells.

August 27, amber color, cloudy, acid, specific gravity 1.018, albumin large amount, sugar negative, abundant pus.

**Pathological report.** The spleen on inspection was normal in size, color and consistency. On its posterior surface there was a rent extending the full length of the spleen. On the upper border there was a laceration 1 centimeter deep and 3 centimeters in length.

**Microscopical report.** Malpighian bodies and splenic pulp presented a normal picture. There was an increase in connective tissue.

**CASE 2.** (Occurred in the service of my associates, Doctors Motley and Smith.) C. R., male, white

age 14 years entered the Abingdon Hospital with a history of an abdominal injury.

The family and past histories were unimportant. *Personal inspection.* While coasting the patient was thrown from his sled and he collided with a large tree striking his left lower chest and upper abdomen. The accident caused considerable pain and dizziness. He managed to walk across the street to a store and later was taken home in a conveyance. He was seen by a physician almost immediately after the accident. The physician noted a temperature of 96 and pulse of 90. At this examination the patient was rigid and tender over the left side of his abdomen. Twenty hours later his temperature was 101 and pulse 140.

*Physical examination.* Twenty seven hours after the accident the patient was admitted to the hospital with a temperature of 100 and pulse of 140. He complained bitterly of an agonizing pain in the left shoulder. This pain was not accentuated by the movement of the shoulder joint nor was there any evidence of trauma. He also complained of pain in his chest and abdomen. Chest examination showed dullness and absence of breath sounds over the lower posterior border of the left lung. The abdomen was flat except for a slight distention of the epigastrium. On palpation the abdomen was extremely rigid and tender throughout and on percussion there was dullness in the left flank extending outward as far as the axillary line and upward to the dullness noted in the left chest.

The urine was negative. The hemoglobin was 70 per cent and leucocytes 6000.

*Operative.* Under ether anesthesia a high left rectus incision was made. As soon as the peritoneum was open a large quantity of blood gushed out. The spleen isolated, ligated, and removed. The stumps of the vessels were sutured with No. 4 catgut. The blood was sponged out of the peritoneal cavity and posterior drainage was inserted.

The patient had lost an appalling amount of blood. Soon after operation his condition became so desperate that a direct transfusion was performed by means of the aheim tube. A nurse acted as the donor. Almost immediately after the blood began to flow the patient's lips became pink, the color returned to his cheeks and he awoke and began to talk rationally.

The postoperative course was somewhat marred by a pleural effusion on the left side.

Blood findings. December 18. Leucocytes 16000 hemoglobin 70 per cent polymorphonuclears 88 per cent small mononuclears 7 per cent large mononuclears 5 per cent.

December 21. Leucocytes 30000 hemoglobin 63 per cent erythrocytes 350000 polymorphonuclears 80 per cent small mononuclears 11 per cent large mononuclears 9 per cent.

December 3. Leucocytes 10000 hemoglobin 65 per cent erythrocytes 400000 polymorphonuclears 83 per cent eosinophiles 5 per cent.

small mononuclears 4 per cent large mononuclears 8 per cent.

December 26. Leucocytes 20000 polymorphonuclears 70 per cent small mononuclears 8 per cent large mononuclears 8 per cent eosinophiles 14 per cent.

December 31. Leucocytes 6000 erythrocytes 420000 polymorphonuclears 75 per cent small mononuclears 10 per cent large mononuclears 1 per cent eosinophiles 14 per cent.

January 5. Leucocytes 20000 hemoglobin 0 per cent red cells 3800000 polymorphonuclears 6 per cent small mononuclears 0 per cent large mononuclears 4 per cent eosinophiles 10 per cent.

January 11. Leucocytes 16000 hemoglobin 0 per cent red cells 380000 polymorphonuclears 72 per cent small mononuclears 4 per cent large mononuclears 5 per cent eosinophiles 0 per cent.

*Pathological report.* The spleen was slightly enlarged for one of his age measuring 0.5 centimeters in length by 0.5 centimeters in breadth by 0.5 centimeters in thickness. The color and consistency were normal. On its anterior surface there was a rent extending through the middle of the spleen.

*Microscopic report.* The malignant bodies were few in number and were pressed apart by an increase of splenic pulp. This increase was due to an infiltration with leucocytes and lymphocytes.

CASE 3. C. P. G. male white aged 46 years entered the Johnston Willis Sanatorium November 1906 with a history of an injury in an automobile accident.

The family and past histories were unimportant. *Personal inspection.* The patient stated that he was injured in an automobile accident which occurred while driving his car over wet roads. He lost control of the car. The car turned over and he was caught between the steering wheel and seat injuring his abdomen. He was released by his companions and stated that he was seized with violent pains in his left shoulder and under the costal arch of the left side. He was moved to a house nearby by the roadside where he stayed for two hours before being seen by a physician.

When first seen in the automobile on arrival at the hospital he was breathing with much difficulty. He had his right hand placed on his left shoulder stating that he was suffering agonizing pain in this region and under the left costal arch.

When placed in bed it was found that his pain was greatly increased when he was in the recumbent position.

Physical examination revealed nothing on inspection except that the patient was breathing with much discomfort and he had an anxious expression. There was not an abrasion or bruise on the skin surface. His temperature was 96 pulse 8 respiration on skin cold and clammy. He was tender all over the abdomen very rigid showed much tenderness in the left costovertebral angle. The pain in the shoulder of which he complained was not accentuated by palpation.

Blood findings showed total white cell count 25 200 with a hæmoglobin of 90 per cent at 7 o'clock one hour later his total white cell count was 23 600 and hæmoglobin 70 per cent

A provisional diagnosis of a ruptured spleen was made from the foregoing data and it was thought best to do an exploratory laparotomy under local anaesthesia to confirm the diagnosis

*Operation* On entering the peritoneal cavity through a left rectus incision a large amount of free blood was encountered We deemed it wise to switch to a general anaesthetic We enlarged the incision located the pedicle of the spleen which was shorter than normal and somewhat adherent by old adhesions As we were unable to get free access to this organ our incision was enlarged by making a left transverse incision The pedicle was ligated the ruptured spleen removed and all the free blood removed with the suction apparatus The wound was closed with drainage Hypodermoclysis was given on the table The stomach was washed and a large amount of dark green fluid was obtained

A transfusion was advised by my associate Dr Budd but he was unable to match his blood with the donors among several of whom was his son The patient reacted well and seemed to improve for the next few days

Blood findings the next day November 13 were as follows

Total white cell count 17 600 hæmoglobin 70 per cent polynuclear 70 per cent small lymphocytes 16 per cent large lymphocytes 14 per cent

November 14 leucocytes 10 800 hæmoglobin 70 per cent Differential not made

November 15 leucocytes 8 000 polymorphonuclears 66 per cent small lymphocytes 12 per cent large lymphocytes 2 per cent hæmoglobin 66 per cent

November 16 leucocytes 7 00 hæmoglobin 66 per cent

November 19 leucocytes 7 000 polynuclears 88 per cent lymphocytes 12 per cent hæmoglobin 60 per cent

*Pathological report* The spleen was not enlarged the color and consistency were normal There was a stellate rent on the anterior surface of the spleen covering a little over half of the surface

The patient was given continuous saline nothing by mouth hypodermoclysis and morphin 1/6 grain every 4 hours when necessary His stomach was washed repeatedly which always brought back a good deal of dark green fluid He suffered a great deal from distention which we were unable to relieve by the ordinary methods The patient's condition seemed about the same for the next 7 days but on the eighth day he began to suffer more than usual with distention the pulse became weak and rapid and on the eighth day he died No autopsy

CASE 4 F C male colored age 15 years entered the hospital September 1 1917 with a history of an injury in an automobile accident

*Personal inspection* First seen by his family physician about one hour after the accident At the time he was unconscious and showed symptoms of concussion of the brain and those of an abdominal injury

*Physical examination* Three hours after the accident the patient was admitted to the hospital in a semiconscious condition There was a slight laceration of the scalp over the right parietal region There were no other evidences of injury on other portions of the body His temperature was 98.4 pulse 74 respiration 26 Reflexes normal eye grounds normal consciousness returning Chest negative Upon examination the abdomen was slightly distended slight rigidity and tenderness over the entire abdomen increased over left rectus muscle

The urine was negative

Blood on admission leucocytes 2 800 polynuclears 81 per cent lymphocytes 19 per cent hæmoglobin 90 per cent Blood examination two hours later leucocytes 2 000 polynuclears 86 per cent lymphocytes 9 per cent large mononuclears 5 per cent hæmoglobin 70 per cent

Abdominal pain increased pulse rose to 116 temperature 100.4 respiration 40 hæmoglobin 70 per cent

*Diagnosis* internal hæmorrhage from rupture of liver or spleen

*Operation* Twenty four hours after the accident the abdomen was opened through a median incision extending from the costal arch down 4 inches The peritoneal cavity contained a large amount of blood The liver was thoroughly explored for fracture but no injury could be discovered The spleen was next palpated and evidences of injury could be made out although the incision did not permit a satisfactory examination A transverse incision was then made through the abdominal wall from the mid point of the first incision to just beneath the left costal arch There was a blood clot adherent to the spleen which on further examination showed two lines of fracture The injury was confined to the inferior half the upper line being just beneath the center of its longitudinal axis The organ seemed to be somewhat enlarged and had only a slight range of movement either on account of very short ligaments or else anomalous fixation bands It seemed to be firmly fixed and some little time was required to mobilize it sufficiently to permit a ligation of the vessels This was done with No. 2 tanned catgut The wound was closed in layers in the usual way without drainage The patient stood the operation fairly well and was given subcutaneous saline leaving the table with a pulse of 130 Postoperative convalescence was satisfactory

*Blood findings* September 19 leucocytes 8 400 hæmoglobin 65 per cent red cells 4.3 0 000 In the course of the next ten days hæmoglobin fell to 60 per cent and then slowly increased reaching 70 per cent three weeks after operation white cell count at that time was normal

In summing up the histories of these 4 cases we find that all present the following points in common

- 1 They were all males
- 2 Blow on left side of body in splenic region
- 3 Secondary anaemia and leucocytosis
- 4 No external evidence of injury about the body
- 5 Rigidity and tenderness of the abdomen
- 6 All had shock following splenectomy
- 7 All the spleens were practically normal in size with short pedicles and without any history of previous disease of the organ

Three out of the four had agonizing pain in the left shoulder which was promptly relieved by splenectomy. The fourth case was a child sent in for concussion of the brain and as he was in a comatose condition we were unable to elicit a satisfactory history.

Three were operated on twenty-four hours after the injury.

In all of the cases a marked increased leucocytosis persisted after the operation over a period of from two to four weeks.

Three cases had satisfactory convalescence. One died eight days after operation.

The fatal case showed a continuous fall in haemoglobin and a decreasing leucocyte count.

In the first cases operation as followed by direct transfusion with apparently good results.

Some years ago in a patient on whom we had done a splenectomy for Banti's disease there was a postoperative bleeding from the pedicle and a second operation was necessary to control hemorrhage. The patient reacted very well from this operation but died a few days later with symptoms suggesting severe anaemia. At autopsy no internal hemorrhage was found and we did not believe that a sufficient amount of blood had been lost from the accident to account for the fatality. Since the amount of hemorrhage found in the cavity at the time of the second operation was not sufficient to have caused death we felt that in some way the removal of the spleen plus hemorrhage had produced a severe secondary anaemia that would not have resulted from the loss of the same quantity of blood from any other abdominal organ. We were strengthened in this belief by the experimental findings of Musser (1) who says

In the dog splenectomy is followed by a decrease in the red blood cells and haemoglobin reaching the lowest level about the twenty-sixth day the haemoglobin varying

from 50 to 65 per cent and the red cells from 800,000 to 3,500,000. From this time to the eighty-second day a constant increase in haemoglobin and red cells occurs the animal not reaching or approximating its normal level however until the end of about four and a half months. Pearce and Austin (2) also experimenting with dogs showed that in the absence of the spleen the function of forming red blood corpuscle phagocytosing cells normally a minor activity of the lymph nodes becomes highly developed in the latter organs and that these cells and the stellate cells of the liver thus assume in part at least the function of destroying red blood corpuscles by phagocytosis.

Having in mind the former unfortunate experience in the case of Banti's disease and also the results of Musser (1) Pearce and Austin (2) just quoted we promptly resorted to transfusion in our first two cases of splenic rupture with most gratifying results. Since however our experience with splenectomy following hemorrhage was small we determined to study the points which had come to light in the three cases with the aid of animal experimentation.

The points we wished to investigate were these: (1) What effect has simple splenectomy upon the blood picture? (2) What changes are produced when splenectomy is performed following a considerable hemorrhage as was the case in our patients with ruptured spleen. (3) In what way does transfusion modify the results of splenectomy? Our experiments may be grouped under three heads: (1) splenectomy with no loss of blood (2) splenectomy with loss of a considerable amount of blood (3) splenectomy with loss of blood and subsequent transfusion.

In our experiments on dogs conducted by Dr S W Budd and myself in 1914 and 1915 the abdomen was opened under ether anesthesia by a high left rectus incision and the spleen delivered through the wound. Ligatures were placed around the splenic artery and vein and also around the entire splenic ligament. In groups 1 and 2 the ligatures around the splenic artery and vein were not tightened until the animal

had lost blood enough to reduce the hæmoglobin to 70 per cent. Indirect transfusion was used in group 3 blood being introduced through the splenic vein. In order to simulate as nearly as possible a ruptured spleen we lacerated the organ and squeezed part of the splenic pulp into the abdominal cavity in all experiments.

Under group 1 splenectomy with no loss of blood eighteen dogs were used. The majority of these showed but a slight decrease in hæmoglobin a small number showed no loss only a few showed a marked decrease to 60 per cent in the first few weeks with a gradual return to normal.

In group splenectomy with dogs bled until the hæmoglobin registered approximately 70 per cent fifteen dogs were used. Most of these showed the same blood picture as the last cases in group 1 which was a gradual decrease to 60 per cent then a slow rise. One case showed a marked anaemia and died on the seventh day. Two others developed a grave anaemia hæmoglobin going as low as 45 per cent followed by a gradual rise.

In group 3 splenectomy animals bled until hæmoglobin reached 70 per cent followed by transfusion. The blood picture in this series of cases was similar to the majority of group 1. In this series 5 dogs were used.

The blood findings in our human cases that recovered simulated the majority of those in groups 1 and 3 that is a gradual decrease in hæmoglobin as low as 55 per cent then a return to normal. The experiments just detailed seem to establish the fact that the destruction of red cells following a simple splenectomy is by no means excessive. A few of our animals however showed a marked secondary anaemia following splenectomy after hæmorrhage and as a result of these observations we are led to the belief that in certain cases of splenectomy following hæmorrhage death occurs as the result of a severe secondary anaemia out of proportion to the amount of blood lost and probably incident to the absence of the spleen.

It will be observed that the studies of the blood in these cases were not elaborate. From

previous experimental work it seemed safe to assume that the anaemia present was of the secondary type and that hæmoglobin estimation represented a fair index of its degree.

We wish to call attention especially to pain in the left shoulder as a symptom of considerable diagnostic importance. This pain is undoubtedly referred from the diaphragm and is due to subphrenic irritation from blood clots around the spleen. Pain of a similar nature in cases of diaphragmatic pleurisy has been referred to by Capps (3) who states that the central portion of the diaphragm receives its sensory nerves from the phrenic nerve which carries afferent impulses to the cervical cord and sets up reflex pain in the corresponding spinal segments namely the third and fourth cervical.

This localization of the pain was apparently first noted by Stubenrauch and Schulze and has been mentioned by Fauntleroy (4) Junker mann (5) Norrlin (7) Brur (7) Mulligan and Hennington (8) and Henschen (9).

The symptom is thus graphically described in Fauntleroy's paper. He complained of a curious deep seated pain in the left shoulder which was not increased by movement of the joint and as examination showed no contusion or dislocation it was thought to be a slight sprain in this region due to the effort to catch himself in falling. It is to be noticed however that this pain disappeared completely after operation and it is possible that it has some diagnostic value when the spleen is traumatically involved. Brogsitter however believes that pain in the left shoulder is of little diagnostic importance as it is seen in other instances of injury of abdominal organs particularly of the left lobe of the liver.

In a paper published in 1909 Brogsitter (10) reviews the literature on traumatic rupture of the spleen and states that up to that date there had been reported 203 cases of rupture of the spleen treated by surgical means. This number may be divided into two series the first one up to and including the cases summarized by Berger in 1907 comprising a total of 168 cases the second up to and including the cases reviewed by Brogsitter a

total of 35. In the first series splenectomy was performed in 135 instances with a mortality of 38.7 per cent. In the earlier papers there was no distinction made between ruptures of the normal and of the diseased spleen but Brogsitter analyzed a series of 66 cases occurring between 1902 and 1909 47 of which were ruptures of apparently normal spleens while the remaining 19 were instances of rupture of the diseased spleen. The mortality after splenectomy was almost the same in these two series being 35.3 per cent for the normal and 53.3 for the diseased spleens.

Barnes in 1914 reviewed the literature since Brogsitter's paper and finds reports of 30 cases of rupture of the normal spleen occurring between 1909 and 1914 his own case making a total of 31. Splenectomy was performed in 26 instances with a mortality of only 7.6 per cent. There have occurred since Barnes' paper or were omitted from his summary 53 cases of rupture of the apparently normal spleen the reports of which have been available. Our own cases increasing this total to 57. Splenectomy was performed on 55 patients with a mortality of 8.88 per cent. Suture tamponade or a combination of these two procedures appears to give a distinctly better result for the mortality of patients treated in this way for the four series is respectively 25 per cent, 0 per cent, 0 per cent and 8.3 per cent. Too much importance should not be attached to these figures however for the condition of the patient at the time of operation undoubtedly was the chief factor in influencing the mortality.

The following cases have occurred since Barnes' paper or were omitted from his summary

- 1 BAUR O spl n t my—re o ry Co Bl f  
sh 12 A zt 9 4 1 1467  
CAM W H O pl n t my—r co e y Br t  
M J 19 6 1 09
- 3 CAT CART C W One t mpon—e ry Tr  
Med Ch 5 c Fd 10 1 89
- 4 COX One pl n ct my—re ry La t I d  
914 1 945
- 5 E CLES W McADAMS One splene tomy—o ry  
W st L nd n M J 913 07 09
- 6 ERIO LLSWORTH O t m p n—re o ry An  
S rg 9 4 1 x 759

- 7 FAUVILEROY 1 M One pl ne tomy—r o ry  
Ann Sug 10 3 1 1 68 7
- 8 GILSON HIRAN One splenectomy—death J  
m'd d Brut 9 3 suppl p 43
- 9 GRASS A D HELL L Three splen ct m s—three  
d aths P m'd d 1 st 19 2 1 45 454
- HAIN O e pl n ct my—d th Med Kl 9 3  
585
- 11 HN V S pl e t m s—f r r o e r s—  
2 d th Ind an M C 0 7 1 46 53
- 11 HN EV One sple ct my—c ry C P f  
h Ae 21 9 5 1 54
- 3 HIRZ R 1 o pl t m s—one r ry—one  
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- 4 HIRAND O ple e tomy—co y I y m'd  
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- 6 JUNE M H I e pl c t m —4 e o r es  
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- 7 J N U pl n ct my—o ry Br t M J  
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- 8 KRUET R O e pl ectomy—ec y Z ntralbl  
f Cl 014 1 58
- 9 LEVIN On ut e—v Med J 5 Af c  
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- 2 L O n spl t my—o ry D t h med  
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- 8 PALMER O tampon—c ery J Am M Ass  
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- 29 REGIN AND UNKER O spl t my—co y  
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- 3 ROUTIER On t amp n—ry Bull t m m  
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- 3 SEIBELT One sple e tomy—ec ry Lanc t  
L nd 9 3 794
- 3 SEIBELT L O spl ct my—r ry Med  
C Bl d W tt mb ae tl L d 01
- I 90
- 33 VASSA O spl ne t my—c ry M tp l  
Thes 19

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## MALIGNANT LEIOMYOMATA

BY MINA SHEPARD PROPER AND BUPTON T SIMPSON M D BUFFALO NEW YORK  
F mth Path l m l Labo t ry l th Stat l t t f the St dy f M l g t d e H R G y l d D t r

**A**MONG the specimens received at the Pathological Laboratory of the State Institute for the Study of Malignant Disease during the past four years that is since we have been making diagnosis of pathological tissues free of charge for the physicians of the state there have occurred twenty two cases of malignant leiomyomata. It was thought to be valuable to analyze and place these cases on record.

A malignant leiomyoma may be defined as a malignant neoplasm arising from mesoblastic cells of the smooth muscle type. It is conceivable that these tumors may originate from either adult smooth muscle cells or from benign tumor cells as found in leiomyomata. The latter origin must be considered as the common one on account of the frequency with which a history of degenerating fibroid accompanies these tumors.

Virchow in his treatise on tumors described in 1863 a myoma of the stomach which underwent a metaplasia to myosarcoma. While he speaks about its originating in the interstitial tissues still his microscopic description of the cells and especially the nuclei leads one to believe that he had to deal with a true malignant leiomyoma to which he gave the name myosarcoma. Ritter described a case of a large fibromyoma of the uterus which showed sarcomatous changes at the center and to which he gave the name myosarcoma. Von Kahliden reviews the literature and after describing many reported cases some of which were probably cases of true sarcoma as well as malignant leiomyoma

ata he describes a personal case which is of especial interest because he claims one can demonstrate histologically a direct transition of a fibromyoma to a sarcoma. Williams after a careful study does not see how von Kahliden can exclude the possibility of the sarcoma cells springing from the interstitial connective tissue although he himself described a case in the sections of which he could demonstrate an actual transition of myoma cells to sarcoma cells. Almost all authors of this period speak of these tumors as myosarcoma but as Ribbert points out the name sarcoma should be reserved for malignant tumors springing from connective tissue. For the smooth muscle tumor which has undergone malignant change he suggests the name of malignant myoma and he would only use the term myosarcoma for the extremely rare cases when true sarcoma and myoma exist at the same time producing a mixed tumor. Ribbert also emphasizes the fact that the term malignant degeneration of a fibroid is improper usage inasmuch as a tumor is not a regressive but distinctly a progressive process. Much discussion has arisen regarding the best terminology to use to designate these tumors arising from the smooth muscle type of cell. Mallory would include all tumors both benign and malignant which are composed of the smooth muscle cell type under the general term leiomyoblastoma. Williams prefers the term myomasarcomatodes because it signifies a sarcoma like tumor which springs from the muscle cells of a myoma. Aschoff Kaufmann and Hertzler use the term myosarcoma while MacCallum prefers the term malignant myoma. It would seem most



rational to use the term suggested by Morpurgo and also used by Ghon viz malignant leiomyoma as this covers the ground and instantly shows one that we are dealing with a malignant tumor comprised of the smooth muscle type of cell. It would seem that we must exclude from this group of malignant smooth muscle tumors so called metastasizing myoma for they are probably really benign and metastasize as the result of the cells of a leiomyoma penetrating a blood vessel and producing another tumor at the place where these cells become lodged.

Malignant leiomyomata are not infrequent and if a more careful examination of all fibroids were made we believe that the statistics reported in the literature would be greatly increased. It is not unusual to find that a single nodule in a uterus containing multiple tumors would show a malignant change. Often the change may be limited to the center of the fibroid. Kelly and Nobel Tracy and Murphy find the incidence of malignant tumors in relation to fibroids to vary between 1 and 2 per cent while the statistics of Gardner and Winter show about 3 per cent. In the cases received at this Laboratory there occurred twenty two malignant tumors among 357 leiomyomata or about 6 per cent. This percentage is much higher than any previously reported but may be partly accounted for by the fact that a specimen with any appearance of malignancy would be more likely to be sent to us for examination while benign tumors might be thrown away.

The majority of these neoplasms occur in the body of the uterus and preponderately arise from pre-existing fibroids. Sixteen of our twenty two cases give a definite history of preceding leiomyoma. One case which consisted of multiple malignant tumors varying from the size of a pin head to a marble apparently sprang primarily from the musculature of the uterus while two other of the cases gave a history of uterine polyps.

The gross appearance of course varies with the stage of progress of the malignant condition when found. In the case of the multiple small tumors which were unquestionably rather early these tumors were circumscribed

nodules such as one finds in leiomyoma but did not give the whorl appearance and were quite homogeneous presenting a grayish white color. When this malignant change is found at the center of an old fibroid that area may present a grayish white to reddish appearance and is soft in consistency. The large ulcerating protruding mass as found in advanced cases is of a marrow white appearance and the consistency of brain tissue. It bleeds easily and is extremely fragile. Sometimes the tumor at this stage protrudes from the cervix into the vagina and reminds one of carcinoma.

The histological aspect varies probably with the rapidity of growth and the degree of malignancy. Some authors include in the group of malignant smooth muscle tumors very cellular leiomyomata and of course it is very hard to draw the line but it would seem that the absence of mitotic figures ought to put doubtful tumors in the benign class as mitotic figures are extremely rare in leiomyomata. Mallory writes. When mitotic figures are present in leiomyoblastoma the tumor is to be regarded as capable of infiltration and of giving rise to metastases and therefore as clinically malignant. Histologically therefore the tumors may vary from those made up of cells of uniform size resembling those which make up leiomyoma but being somewhat shorter and plumper with here and there a mitotic figure up to tumors comprised of cells which are extremely irregular in size and shape some being masses of protoplasm with giant or multiple nuclei and showing all varieties of atypical mitotic figures. Mallory described the type cell of a leiomyoblastoma as a long spindle cell with a rod shaped nucleus and acidophilic protoplasm. We believe that it could be possible in all malignant leiomyomata to find somewhere in the tumor this type of cell. One may classify malignant leiomyomata histologically into three types according to their variation from the smooth muscle type cell (1) those resembling very closely the leiomyomata (2) those having a short plump spindle shape with oval nuclei and (3) those having a great variation in the morphology of the cells.

Fig 1

Fig 3

Fig 5

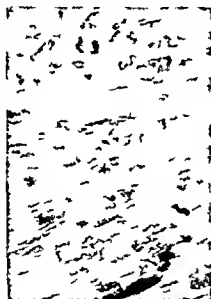
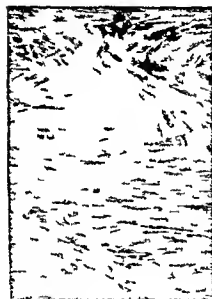


Fig 2

Fig 4

Fig 6

Fig 1 Type I leiomyoma showing long spindle cells with rod shaped nuclei having rounded ends. The cells are shorter than the type cell with relatively more protoplasm tend to regularity in size and mitotic figures are infrequent. The second type (Figs 3 and 4) is composed of shorter plumper spindle cells an oval and vesicular nucleus

Fig 5 Type III leiomyoma showing a great variation in the morphology of the cells and consists of short spindle cells large round cells and numerous giant cells containing single or multiple nuclei and presenting great irregularity of the chromatin elements. Undoubtedly these different histologic

The first type (Figs 1 and 2) is composed of long spindle cells with a rod shaped nucleus having rounded ends. The cells are shorter than the type cell with relatively more protoplasm tend to regularity in size and mitotic figures are infrequent. The second type (Figs 3 and 4) is composed of shorter plumper spindle cells an oval and vesicular nucleus

with numerous typical and atypical mitotic figures. The third type (Figs 5 and 6) shows a great variation in the morphology of the cells and consists of short spindle cells large round cells and numerous giant cells containing single or multiple nuclei and presenting great irregularity of the chromatin elements. Undoubtedly these different histologic

ical appearances are indicative of different degrees of malignancy for the reports of the results of these cases so far as we were able to ascertain agree very well with the histological findings that is those cases which showed much variation in cell structure suffered recurrences with ultimate death while the cases still living were of the type which showed least deviation from the leiomyoma type cell.

For purposes of reference a brief history of our cases is given below which includes the outcome of each as far as we are able to ascertain it of the type from the histological standpoint.

CASE 1. Isth No. 3. Date Oct 1. 1914.  
Age 64 married. Clinical diagnosis: adenoma of the uterus. Location: cavity of uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months later of hemorrhage.

CASE 2. Isth No. 40. Date May 3. 1914.  
Age 40 married. Clinical diagnosis: uterine polyp. Location: fundus near left tubal opening. Microscopic diagnosis: malignant leiomyoma. Type II. Result: died 1 month after operation from carcinoma.

CASE 3. Isth No. 29. Date July 6. 1914.  
Age 4 married. Clinical diagnosis: carcinoma. Location: peritrium. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months from recurrence.

CASE 4. Isth No. 3343. Date December 16. 1914.  
Age 2 married. Clinical diagnosis: growth from vagina. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months later of cause not known.

CASE 5. Isth No. 490. Date April 10. 1915.  
Age 4 married. Clinical diagnosis: leiomyoma. Location: cervix. Microscopic diagnosis: malignant leiomyoma. Type II. Result: died 1 year later.

CASE 6. Isth No. 463. Date June 1. 1916.  
Age 5 married. Clinical diagnosis: leiomyoma. Location: fundus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months later of cause not known.

CASE 7. Isth No. 426. Date July 10. 1916.  
Age 3 married. Clinical diagnosis: leiomyoma. Location: fundus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months later.

CASE 8. Isth No. 99. Date September 1. 1916.  
Age 48 married. Clinical diagnosis: degenerated fibromyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months later.

myoma. Type II. Result: alive no evidence of recurrence.

CASE 9. Isth No. 360. Date November 4. 1916.  
Age 54 married. Clinical diagnosis: leiomyoma. Location: cavity of uterus. Microscopic diagnosis: malignant leiomyoma. Type II. Result: died 1 year later.

CASE 10. Isth No. 670. Date December 16. 1916.  
Age 4 married. Clinical diagnosis: carcinoma. Location: cavity of uterus. Microscopic diagnosis: malignant leiomyoma. Type I. Result: patient alive.

CASE 11. Isth No. 614. Date February 10. 1917.  
Age 58 married. Clinical diagnosis: leiomyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 1 year later.

CASE 12. Isth No. 338. Date September 1. 1917.  
Age 64 married. Clinical diagnosis: leiomyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 1 year later.

CASE 13. Isth No. 1400. Date September 13. 1917.  
Age 3 married. Clinical diagnosis: leiomyoma. Location: body of uterus. Microscopic diagnosis: malignant leiomyoma. Type I. Result: patient alive.

CASE 14. Isth No. 613. Date October 1. 1917.  
Age 6 married. Clinical diagnosis: leiomyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 1 year later.

CASE 15. Isth No. 914. Date December 1. 1917.  
Age 6 married. Clinical diagnosis: leiomyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type II. Result: died 6 months later.

CASE 16. Isth No. 834. Date March 20. 1918.  
Age 6 married. Clinical diagnosis: leiomyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months later.

CASE 17. Isth No. 835. Date April 1. 1918.  
Age 4 married. Clinical diagnosis: leiomyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months later.

CASE 18. Isth No. 8922. Date May 4. 1918.  
Age 42 married. Clinical diagnosis: leiomyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: patient alive.

CASE 19. Isth No. 1160. Date June 1. 1918.  
Age 60 married. Clinical diagnosis: leiomyoma. Location: uterus. Microscopic diagnosis: malignant leiomyoma. Type III. Result: died 6 months later.

CASE 20 Path No 9 2 Date June 1 1918  
Age 48 married Clinical diagnosis fibroid  
Location body of uterus Microscopic diagnosis  
malignant leiomyoma Type II Result still  
in life Health fair No evidence of recurrence

CASE 1 Path No 945 Date July 11 1918  
Age 68 married Clinical diagnosis fibroid degener-  
eration Location posterior wall of uterus ad-  
herent to mesentery Type II Result died 40  
days after operation from pneumonia

CASE 2 Path No 10063 Date October 26  
1918 Age 47 married Clinical diagnosis car-  
cinoma Location cervix and endometrium  
Microscopic diagnosis malignant leiomyoma  
Type I

It will be seen that in all the cases except one (21 out of 2) the patients were married women. This is somewhat above the normal relation of single to married women which is usually estimated as 1 to 13 although it would be difficult to connect marriage with the etiology of malignant leiomyoma. The age incident varied from 3 to 72. However 9 occurred between 40 and 65 and 8 of these were in the forties.

The clinical diagnosis received with the specimens varied greatly in exact diagnosis not being made in any case although 7 were described as degenerating fibroids and 5 others were diagnosed as malignant carcinoma or cancer. Begoum states that an accurate diagnosis can only be made with a microscope but that one should be suspicious of malignant change when bleeding and rapid growth are added to the symptomology of a fibroid.

While the majority of these tumors originated in leiomyomata in some the tumor was said to have sprung from the body of the uterus others from the cervix and two were described as polyps. When a tumor has become well advanced it is not always easy to tell its exact origin. On two occasions we have found a malignant change in very small leiomyomata.

The relation of the various types to the number of our cases is as follows. Type I three cases. Type II eight cases. Type III eleven cases. In discussing the end to which these conditions lead we of course must take into consideration the fact that a number of cases are too recent to decide their outcome definitely. Our statistics show that two of the

cases of Type I have remained well one and two years respectively. Of the cases of Type II four have remained well two died soon after the operation and two died some time later with evidence of recurrence. Out of the eleven cases of Type III one remains well 6 months having elapsed since operation and one shows evidence of recurrence. Two died soon after the operation while seven died from recurrences in period varying from 6 to 11 months after operation.

The earliest authors described malignant tumors such as are included in this series under the general name endothelioma. Upon more careful study they were reclassified under the term *myosarcoma* meaning a mixed tumor resulting from a true sarcoma arising from the interstitial connective tissue of a leiomyoma. Later many of these tumors were described as true malignant tumors formed from the smooth type of muscle cell and very frequently occurring in pre-existing fibroids but were considered relatively rare as compared to sarcoma. It would seem from the statistics of this laboratory that the common type of mesoblastic malignant tumor of the uterus is the malignant leiomyoma and that true sarcoma is an exceedingly rare tumor of the uterus.

We have divided malignant leiomyomata histologically into three types according to their variation from the smooth muscle type cell and believe that their malignancy is somewhat in accord with their histological type. It may be however that the division into types is purely artificial and only represents stages in the growth of the tumor that is the earlier the tumor is found the nearer it holds to the smooth muscle type of cell. In any event the tumors which we received that were large and broken down were usually of Type III.

It may be possible that Type I represents the borderline but there can be no doubt of the malignancy of the other types. In connection with the question of malignancy one may consider these tumors of a low form in their earlier stages for they have little tendency to metastasize but in their later stages their power of infiltration is considerable and recurrence is the usual sequence of

their removal. It is well also to emphasize the warning of Ceast that the treatment by X-ray or radium of fibroids is dangerous in women past 40 years of age because if malignant change has taken place the treatment is of no avail and valuable time may be lost.

### CONCLUSIONS

1. Malignant leiomyomata are not uncommon.

2. They arise most frequently from premenopausal leiomyomata.

3. The three histological types into which malignant leiomyomata may be divided independently correspond with their degree of malignancy.

4. In view of the frequency of malignant

change in fibroids we believe they should be removed surgically as soon as discovered.

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## CLINICAL EFFICIENCY AND TERMINOLOGY IN CANCER OF THE BREAST

BY WILLIAM CALVERT M. CALVERT, M.D.

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**I**N spite of the fact that cancer of the breast has been abundantly and excellently considered by the best authorities over a long period of years there are some reasons why it demands renewed interest.

Besides the pathological fact there are four parties concerned from the standpoint of efficiency in dealing with this condition which is of such economic and humanitarian importance. Each party represents a different degree of opportunity to handle facts relative to diagnostic probability and certainty. The one with the least certainty and fewest facts is the patient; the one with the most facts and greatest certainty is the pathologist; the clinician and surgeon are the intermediaries between these two. Perhaps the statement will not be accepted immediately by clinicians and surgeons both of whom in the absence of clinically inclined pathologists have of necessity been forced to assume the role of clinician and pathologist the first and last courts.

A combined clinician, surgeon and pathologist would be an ideal individual and such an one was possible a few years ago when

clinical knowledge, surgical experience and pathological fact were limited. Today each represents a specialism in the field of medical science the many branches of which have grown to such proportion that no one in a division can comprehend all clinical facts, perform efficiently all operation or master the subject of pathology completely. Each must know all of the facts upon his own subject and all must know enough of relationships to assist in the correlation of the knowledge of all parties.

Since cancer of the breast starts as a microscopic condition for which no specific cure has been discovered it possesses important significance long before it becomes possible for the patient, clinician, surgeon or pathologist to recognize its presence by any known method. From the standpoint of gross diagnosis of the early presence of the condition in the patient all parties deal only with probabilities which approach certainty usually in direct proportion to size of growth or its proximity to the skin or underlying muscle. Fixity, however, is not absolute a active clinicians, surgeon and pathologist know

A comparative study of pre operative clinical and pathological diagnoses reveals the following facts relative to the clinician's diagnostic relation to cancer of the breast in two large series

	N	F mb	t S	P	C	t	N	Sec mb	IS	C	I
Breasts removed	1800						300				
Positive pre operative clinical diagnoses	1326				84	8	11		12	3	
Doubtful pre operative clinical diagnosis				14	15		53		21	23	
Positive pre operative diagnosis correct regarding malignancy or benignancy	1146					5	100		91		
Positive pre operative diagnoses in correct regarding malignancy or benignancy	390				25		18		8	3	
Expressed positive diagnoses of malignancy correct regarding malignancy				5	94	2	111		94	0	
Expressed positive diagnoses of malignancy incorrect regarding malignancy or benignancy	44				5	8	6		5	1	
Expressed doubtful diagnoses of malignancy correct regarding malignancy or benignancy	93				58		21		6	1	
Expressed doubtful diagnoses of malignancy incorrect regarding malignancy or benignancy	68				4		10		3	3	
Expressed positive diagnoses of benign conditions correct regarding malignancy or benignancy	41				91		91		96	6	
Expressed positive diagnoses of benign conditions incorrect regarding malignancy or benignancy	41				0		14		13	4	

m r e l y m d t g b l p t t d g n l m y t h t t h l y i  
p r e s e d l c a r c m m t t t h l p e c i l l y t a t d h

	N	F mb	t S	P	C	t	N	Sec mb	IS	C	I
Expressed doubtful diagnoses of a benign condition correct regarding malignancy or benignancy	10								13	86	6
Expressed doubtful diagnoses of a benign condition in correct regarding malignancy or benignancy	3			3					13	4	
Diagnoses of nodule tumor or mass or no diagnosis	305								39	13	
Of diagnoses of nodule tumor etc malignant	60			17	5				1	1	0
Positive diagnoses of malignancy	160			4	6				11	30	
Doubtful diagnoses of malignancy	161			8	0				31	10	33
Carcinoma diagnosed in laboratory	933			51	53				148	40	33
Carcinoma not diagnosed positively by clinician	98			3					5	4	
Of malignancy the clinician diagnoses with certainty only	15				7				111	75	
Of the not diagnosed positively the clinician has expressed suspicion in	93			44	5				1	51	

Two series were studied for the purpose of determining statistically the elements of certainty and probability in clinical diagnosis from a terminological standpoint in relation to pathological facts and terminology. The first series of 1800 cases (10) represents the first 1800 cases and the second series the last 300 cases which have come under observation. The pre operative diagnosis or instructions to the surgeons were made by clinicians whose experience ranged from 5 to 25 years and whose training had been obtained in the representative medical schools of the United States and Canada and in some instances the leading institutions of Europe.

From these studies the following generalizations may be made relative to actual clinical efficiency when endeavoring to differentiate all malignant conditions from all benign conditions in the breast.

	P	F
General positive diagnosis are relatively fewer than formerly		94.8
Correctness of general positive diagnosis is greater than formerly	97	
Specifically expressed positive diagnosis of malignancy are mainly identical same	93.9	34
Confirmed doubtful diagnosis of malignancy are more correct than formerly	6	5
Correct predicted positive diagnosis of malignancy are mainly identical same	96	91
Presumably doubtful diagnosis of malignancy are more frequent than formerly	96.6	
Diagnosis of tumor masses are less than formerly	13	2
Of all breast conditions the benign ones are positive diagnosis of malignancy are about the same percentage	30	4.6
Operable benign tumors are about the same relative frequency	40.3	1.5
The benign ones are a faithful diagnosis in all circumstances more frequently than formerly	2	1
This is especially expressed in the case of malignant carcinomas		
Of the cases of malignant neoplasms diagnosis is definitely expressed as a suspicion rather than a certainty	5	44.5
Out of all the breast conditions only 20 per cent are referred to the laboratory for histological confirmation		

Although these figures vary slightly from time to time the fundamental facts relative to diagnostic certainty remain the same. Clinicians and surgeons are dealing with fairly definite percentages of certainty and probability the former of which will become less and less as the human and clinician become educated to the recognition of pathologic although indefinite conditions.

The factors of uncertainty in clinical and even gross diagnosis are emphasized in the

following statistics which show the necessity of microscopic diagnoses after specimen have been removed from the body.

Total number of general pathologic diagnoses recorded between August 1 1917 and December 1 1918 is 36.

Percentage of diagnoses which were of necessity microscopic 21.8 per cent.

The breast presents a smaller figure for necessity microscopic diagnosis than do general specimens the former being 13.3 per cent.

The efficiency of pathologic terminology when utilized as clinical terminology in diagnosing mammary conditions is seen in the following list of positive pathological mistakes which occurred in the series of 1800 cases.

	CL	ID
Diffuse carcinoma	all	d h c m t t
Carcinoma	ll	l n l d m
Fibroadenoma	ll	i l m
Fibroma	all	d a n m
Adenoma	ll	d h d
Idiopathic adenoma	ll	d e t n s t
Adenoma	ll	d l s b m
Adenoma	ll	d a n o r
Fibroadenoma	ll	d f m
Adenoma	ll	d m m a
Carcinoma	ll	d h m t t
Carcinoma	ll	d h m t t
Carcinoma	all	d i m
Carcinoma	ll	d h m t t
Fibroadenoma	ll	d c h m t t
Fibroadenoma	ll	d m
Fibroadenoma	ll	d y t
Fibroadenoma	c	ll d s t i m
Fibroadenoma	c	ll d d m t l y
Fibroadenoma	ll	i s t i c m
Fibroadenoma	c	ll i d m
Fibroadenoma	ll	d i b m a
Fibroadenoma	ll	f h c m t t
Fibroadenoma	ll	h b r m m t t
Fibroadenoma	ll	d h m m t t
Fibroadenoma	ll	d d e
Fibroadenoma	ll	y t l m
Fibroadenoma	ll	d m
Fibroadenoma	ll	f b a d m
Fibroadenoma	ll	d h i m a t t
Fibroadenoma	ll	i n m
Fibroadenoma	ll	f b m
Fibroadenoma	ll	d m
Fibroadenoma	all	d m
Fibroadenoma	ll	d m
Fibroadenoma	ll	f f t m
Fibroadenoma	f 800 p m	h f l t
Fibroadenoma	ppl d l y	tl s th l k t t
Fibroadenoma	Ad	f b m y m
Fibroadenoma	Ad	m y m
Fibroadenoma	B	g
Fibroadenoma	C	t
Fibroadenoma	P h l g m	I b y h l







Glandular carcinoma	Lactation cancer
Acute encephaloid carcinoma	Paget's disease
ma	Colloid carcinoma
ASCHOFF	
Fibro adenoma	Carcinoma en cuirasse
Fibro adenoma pericanalicular	Carcinoma medullare
Fibro adenoma intracanalicular	Carcinoma cirrhosum
Adenoma of fibroma	Pseudoepithelioma
Adenolipofibroma	Colloid carcinoma
Adenofibrosarcoma	Paget's disease (epithelioma of nipple)
Cystadenosarcoma phyllodes	Melanoma
Solid adenoma	Fibroma
Involucrum cyst	Sarcoma
Mastitis cystica chronica	Chondroma
Carcinoma	Osteoma
	Endothelioma
	Pentelioma
ZIEGLER	
Mastitis	Intracanalicular fibrosarcoma
Perimastitis	Adenocarcinoma
Cysts	Lipoma
Hypertrophy	Anoma
Adenoma mammarium	Chondroma
Adenoma acinosum	Osteochondroma
Adenoma tubulare	Osteoma
Adenofibroma	Cystocarcinoma mammarium
Fibroma pericanalicular	Adenocarcinoma papilliferum
Fibroma intracanalicular	Acinous cancer
Adenocystoma	Tubular scirrhous cancer
Adenocystoma papilliferum	Cystocarcinoma
Cystoma	Carcinoma simplex
Fibroma phyllodes	Carcinoma medullare
Sarcomaphyllodes	Carcinoma acinose
Adenomyofibroma	Carcinoma tubulare
Adenosarcoma	Cancer en cuirasse
Endothelioma	Paget's disease
Fibrosarcoma	Pseudoepithelioma
Myosarcoma	
MACCARTY	
Carcinoma	Adenoma
Paget's disease	Adenofibroma
Medullary cancer	Intracanalicular fibroadenoma
Scirrhous cancer	Intact papilloma
Adenocarcinoma	Intracanalicular myxofibroma
Comedocarcinoma	Medullary tumor
Collid carcinoma	Sarcoma
Cancer en cuirasse	
Chronic cystic mastitis	

The very fact that there is no definite uniformity in the pathologic terminology is evidence of the fact that pathologists themselves are not perfectly clear in their own minds relative to conditions which they attempt to handle that is pathological conditions in the breast. At least they have not gotten together in order to unify conceptions and terminology. This has led to great confusion for the clinician.

In view of the facts herewith presented relative to clinical diagnostic and pathologic terminologic efficiency it seems necessary to

present a scheme of terminology which represents greater efficiency not only from the standpoint of biopathological facts upon which the new terminology is essentially based but also from the standpoint of clinical efficiency.

It is not necessary to review in detail the anatomy of the breast in order to state the fundamentals which underlie a simple conception of our subject. In so far as carcinoma from which all other conditions must be differentiated and which represents the majority of malignant conditions is concerned the breast consists of certain definite tissues: epithelium of the skin, modified epithelium of the ducts and sinuses and adenotexture lining the acini which are the structural and functional mammary units (Fig. 1). Each of these tissues rests upon cells which have been demonstrated to be reserve cells for their regeneration. These reserve cells have been termed epithelioblasts and adenoblasts respectively (8). These three and these three tissues only and their respective regenerative cells are concerned in the question of carcinoma and epithelioma of this organ. Since epithelioma of the breast is a rare condition and presents itself as a superficial lesion which attracts attention early and is easily diagnosed it is of little importance in comparison to the subject of carcinoma which is the main subject under consideration. We are interested for the present only in the modified epithelium of the ducts or tubules and the adenotexture lining the acini with their respective regenerative cells.

For the sake of those of the profession who still rely upon their gross diagnosis it must be emphasized that these tissues are composed of microscopic cells and any changes occurring which involve a dozen or perhaps more of such cells would escape the notice of the most experienced gross pathologist although he might be assisted by a hand lens.

From a practical standpoint the question arises: What is the smallest carcinoma which can be positively recognized clinically? This is in our experience an unanswerable question because neoplasms in the breast are associated with many variable conditions: some breasts contain much fat, others con-



If one desires to express the facts symbolically this may be done in the following manner

$$\begin{array}{l}
 \text{Al mm} \\
 \left[ \begin{array}{c} \Delta \\ \lambda \\ O \\ \Theta \\ \Phi \\ T \\ H \\ \Psi \\ I \\ n \end{array} \right] \\
 \left\{ \begin{array}{c} \text{Prim ry} \\ S d ry \\ T t y \end{array} \right\} \\
 \left\{ \begin{array}{c} p \\ d \\ my \\ 1 \end{array} \right\} \\
 \left\{ \begin{array}{c} \text{Prim ry} \\ S d ry \\ T t ry \end{array} \right\} \\
 \text{Def 11}
 \end{array}$$

Th G l l t t h th f l l g m b o l m g  
 $\Delta D l t = u m b d p l t l$   
 $\lambda l m b d = d f - e p l t d$   
 $O m = c y t$   
 $\Theta t h l = t y l$   
 $\Phi p h = t y l$

T T = l t l  
 $\Pi p = l d t l$   
 $\Psi p = t d l l$   
 $P h = p l l r y$   
 $\Omega m g = p o l p h d$   
 $- g m = l t l$

This terminology deals only with tissue reactions coincident to regeneration of which neoplasia is but a phase. It does not attempt to express etiological factors. It is not expressive of the so called inflammatory conditions although in these the most important consideration from the patient's standpoint is one of tissue regenerative reactions.

Such a terminological key (9) has served in our laboratories of surgical pathology to present accurately simply and briefly the anatomical location biological reactions degree of biological reactions and degrees of cellular differentiation from which facts more accurate clinical data can be inferred with greater simplicity than from any terminology with which the writers have had to deal.

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## IRRITATION OF THE DURA

## OR INNER PERIOSTEUM OF THE SKULL

B. CASSIUS C. ROBLEY, M.D., F.A.C.S. CHICAGO

THE human body is divided into three great cavities the abdominal lined by its parietal and visceral peritoneum the thoracic with its parietal and visceral pleura the third and one that interests us the cranial with its dura and arachnoid. Anatomically the dura will be considered under two heads the outer layer or true periosteum of the inner skull and the inner layer or as it may be properly called parietal layer of the subdural space. Therefore we find the three cavities with similar linings.

The normal contents of the cranial cavity are all important to life and paramount to man's duties and relations to society. To arrive at an intelligent prognosis is it important that the etiology of the intracranial lesions and the extent of the damage done be ascertained. The means of obtaining a comprehensive knowledge of the extent of the lesion and the assistance one can give to nature to restore these structures to a normal function is our object. It is my intention to limit my remarks to the periosteum commonly called the dura and the symptoms which the patient may manifest from irritation to this structure.

The cranial cavity normally contains just sufficient structures to fill it and the slightest variation therefrom will produce symptoms.

The periosteum lining the inner skull is identical to and contiguous with the outer periosteum of the skull at all the foramina so that the skull is covered on its intracranial surface over its entire bony area as there are no attachments of muscles or ligaments to the inner skull as we have on the outer surface. We are then to deal with the true periosteum and all the pathological conditions and complications to which the periosteum may be affected in any other part of the body.

The greatest part of the brain is not sensitive to pain and can be manipulated and explored while the patient is awake and conscious without producing discomfort. This

is not true with the dura or periosteum. The rich nerve supply of the dura the trochlear ophthalmic emilunar ganglion vagus hypoglossal and sympathetic nerves render it one of the most sensitive structures in the body and the slightest irritation produces agonizing pain. Its rich blood supply the anterior meningeal from the ethmoid branch of the ophthalmic the middle meningeal viz the great and small middle meningeal from the internal maxillary the meningeal branch of the rich facial and of the internal carotid and the meningeal branch of the ascending pharyngeal the posterior meningeal which arises from the ascending pharyngeal the occipital and the vertebral all are distributed to the dura or periosteum over the posterior cranial fossa (Suttee). This great volume of blood going to the dura or periosteum is largely returned by way of the venous sinuses making the dura or periosteum an easy prey for toxins that are carried in the blood stream. Again by its proximity to the accessory sinuses it is readily inflamed or irritated when the sinuses become the seat of disease. The irritation of the dura or periosteum may be considered mechanical or infective and these under the subheadings acute and chronic.

Under the acute would be considered depressed fractures with loose picula of bone and foreign bodies such as pieces of steel bullets etc. As these are readily diagnosed and the surgical interference is universally recognized we will spend no time in considering them.

The chronic condition however are well worth our consideration as it is these that are frequently overlooked. The most frequent of these in my experience has been the deposit of lime salts in organized extradural or strictly speaking subperiosteal blood clots. After the acute hemorrhagic condition subsides the patient may be apparently well for weeks months or even years before any localized symptoms manifest themselves. The symp

toms are pathognomonic and should be easily recognized. There is usually a history of a previous injury which may have been considered trivial by the patient at the time and has long been forgotten until headaches appear always localized in a definite area on the skull. The headaches may be constant but more frequently are paroxysmal. They are exaggerated by bodily and mental fatigue and are more frequent at night. They are agonizing of gnawing tearing character and often associated with dizziness and vomiting. The pulse temperature and respirations may be normal and the blood count negative. During the attacks the cerebration is slow. The severity of the attacks may be epileptoid in character and the patient may be mentally irresponsible for his acts and deeds. It is not infrequent for these patients to become heavy drinkers using profane and most vile language during the seizures. They become adept liars and may resort to petty thievery. As the attacks become more and more frequent and severe it is not at all unusual to find these cases declared insane and sent to sanitariums for treatment. It is true they act insane but it is a pseudo insanity due to a constant irritation and not to an actual brain lesion as the insanity disappears after the removal of the irritant and the patient again becomes normal mentally in his acts and habits.

I will now cite the history of the first case of this kind upon whom I operated in 1907 or eleven and one half years ago.

Mr. B. age 31, a laborer married father of two healthy children family history negative. Several years previous to his illness he received an injury to the head which was considered slight. A physician was not called. Some years following the injury while working for the Chicago Telephone Company and traveling from one side of the city to the other by means of a bicycle he would complain of headache in the right frontal region severe and localized to the size of a silver quarter. As the pain became more and more severe he would have lapse of memory failing to return home after work and while he was a temperate man at normal times he would frequently be found in saloons. He was once found in Iowa and had no recollection of how he got from Chicago. Another time he was found in Washington Park with his bicycle wrecked and he himself curled up under some bushes. He had no recollection of going from his home to Washington Park. He became unruly and vicious during the

attacks. In 1900, he was trephined over the area of the previous injury the area of the localized pain. When a bone plate two inches in diameter was removed the dura or periosteum was found to be covered for an area of one inch in diameter with lime salts giving the periosteum much the appearance and roughness of sandpaper. The bone was not replaced the dura or periosteum not opened the skin was sutured without drainage and the wound healed by primary union. The patient has not had an attack of pain or lapse of memory he has not become intoxicated since the operation and has held a responsible position ever since.

The report of a case similar to this with an almost identical history and upon whom I operated in 1917 is given below.

Mr. P. age 35 American family history negative. At the age of sixteen he fell from a building striking his head upon a rock which rendered him unconscious for about an hour. He managed to get up and go home. He was away from school for three days and was apparently slightly injured and nothing more was thought of it for nine years when he commenced to have dizzy spells became nervous and irritable with almost constant localized headache. He gradually grew worse during the next seven years until 1915 when his headaches became so severe that the pain was unbearable. He became careless in his habit neglected his business and his home and became a heavy and habitual drinker. In the summer of 1916 he became so unruly that he was sent to a sanitarium. In March 1917 he was brought to the University Hospital. By the aid of stereocentgenograms a depressed inner plate of the skull was easily demonstrable with what was thought at the time to be a loose spicula of bone but at the operation this was found to be a calcified subperiosteal blood clot that is the dura had the appearance and roughness of sandpaper. A plate of bone three inches in diameter that had been removed was not replaced. The entire area is now covered with bone demonstrating the ossification function of the so called dura or a true periosteum. This man has not had a headache has not drunk a drop has not had a lapse of memory nor a brain storm since the operation and is working every day.

I cite these two cases from a series of similar cases that I have operated upon in all of which the results have been equally as satisfactory. There has been no operative mortality.

The second class of cases I wish to present comprises the acute subperiosteal infections following infections of the accessory sinuses. The symptoms are so similar from all of the sinuses that we can classify them together. First there is a history of a sinus infection

As soon as the dura or periosteum becomes irritated there are characteristic symptoms that should tell one at once that the infection has gone beyond the sinus. The pain is increased and is exaggerated upon external pressure. The discharge from the sinus frequently becomes less. Often where there has been a temperature of 102 or 103 F. as soon as the dura or periosteum becomes irritated the temperature becomes normal or subnormal. From the irritation produced by the infection the dura or periosteum becomes edematous which causes intracranial pressure. I have previously stated that the cranial cavity is large enough to hold its normal contents only and the slightest addition manifests itself by definite signs and symptoms. The pulse and respirations become slow and the blood pressure rises in direct ratio to the increased intracranial pressure. There may be a pathological leucocytosis or the blood examination may be negative. There is projectile vomiting usually associated with dizziness and gradually mental symptoms appear. They are first indifference second slow cerebration and third coma may develop. As this is an acute subperiosteal infection and is liable to extend through the periosteum and inflame the soft structures it may produce meningitis or brain abscess. This is all the more reason why the irritation or inflammation of the periosteum should be recognized early and treated as any acute subperiosteal infection that is by relieving tension thus arresting the progress of the disease. This can be done only by opening the skull exposing the dura or periosteum and thereby establishing free drainage. The dura or periosteum should not be opened. I will now present a case belonging to this class.

Mr. W. Hungarian, 160 married age 33 six weeks before present illness at the University Hospital he complained of severe headache. Shortly afterward there was a discharge from the external ear. He went to a physician who irrigated the external auditory meatus but his symptoms grew steadily worse. At this time a swelling developed back of the ear. He went to a second physician who repeated the irrigations and gave him a syringe telling him to wash out his ear at frequent intervals. His pain however did not subside. He went to a third physician for a foreign ear specialist in Ear, Nose and Throat. This specialist pronounced him to be a chronic

*Case 1.* The leeches were applied back of his ear and he was given a hypodermic injection of vaccine told to return in 10 days for another treatment. When again the leeches were applied and he received a second injection of vaccine 10 days later he complained of a terrible headache and vomited. When I saw him he had slow cerebration no leucocytosis normal temperature slow pulse increased blood pressure and cerebral vomiting at intervals. I advised immediate operation for I was confident the man had a mastoiditis that had extended to and was irritating the dura or periosteum. He was taken directly to the operating room. As soon as an incision was made through the skin and the outer table of the mastoid antrum removed the pulsations ceased in large quantities. The roof of the mastoid antrum was found necrotic and the granulation tissue of the periosteum presented itself. A plate of skull was removed from the mastoid process so as to establish free drainage. The lateral sinus was exposed to the extent of two and a half inches. The wound was left entirely open with the dura or periosteum exposed. The patient was in a critical condition for ten days after which time he made a permanent recovery.

The third case I wished to present was one of hypertrophic periostitis with necrosis of the skull following acute mastoiditis.

In 1911 the patient developed acute mastoiditis on the right side followed by an extradural and subperiosteal abscess. After suffering from severe headache for a year and half the mastoid was operated upon but the extradural abscess was overlooked. In 1915 she came to me I reoperated upon the mastoid and drained the extradural abscess. The patient was relieved for some time but within eighteen months the pain returned repeatedly and I have operated upon her several times for isolated extradural abscesses in different areas of the skull. I have removed in all twenty-three and one half square inches of skull. For the last two months she has been free from pain.

To establish a diagnosis in these cases I have carefully considered the history, complete laboratory and X-ray findings and in the recent ones have had the benefit of the roentgen localization test of Abderhalden. I wish to emphasize the fact that in the cases of cerebral irritation due to deposits of lime salts on the dura or periosteum a flat X-ray plate is absolutely valueless. The only plate that can be relied upon are the stereoradiograms and the same must be made by an expert and at least three sets of plates should be made by concentrating the rays upon three different areas of the head. The flat X-ray plate will

not show the deposited lime salts when taken through the skull as being independent of the bone and it is only the stereos that will show that the deposit is not a part of the skull but lies a short distance internal to it

I want to state further that a set of stereo plates are useless unless there is some one to read and properly interpret the findings that have been produced upon the plate

The serologic work as done at the Durand Hospital by Dr Retinger has opened a new field in diagnosing and localizing brain

lesions In cases as above cited I believe this work will be of value and is fairly reliable and will become more and more beneficial as Dr Retinger continues his research But should it fall into the hands of the general laboratory worker with careless and slipshod methods it will fall into disuse and be thrown in the discard and science will be the loser So let an attempt be made to keep this work in the hands of the conscientious careful worker as work of this kind must be done by an especially trained and extremely careful man

## THE SURGERY OF TENDON TRANSPOSITION WITH SPECIAL REFERENCE TO THE IMPORTANCE OF THE TENDON SHEATH<sup>1</sup>

By M A BERNSTEIN M D CHICAGO

THE object of this paper is to show the results of some experimental work performed in connection with the surgery of tendon transplantation or rather as it might be more correctly described tendon transposition

Before describing these experiments and their results it will be well to glance at the evolution and present status of tendon surgery its clinical results as well as at some of the findings of experimental research work regarding tendon regeneration so that we may be in a position to judge how far the present day procedures are susceptible to improvement

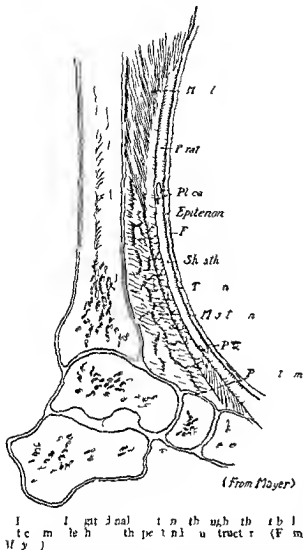
A perusal of the literature of tendon transpositions appears to show a few points quite clearly first it seems a well established and acknowledged physiological fact that under certain conditions a healthy tendon can take up the function of a paralyzed tendon second that this transference of tendon functions is surgically possible third that although the transposition of a tendon is a practical surgical procedure the functional result that should follow does not always occur Some operators get good results others do not Even the same operator's results are not so constant that any method can be relied upon to give fairly uniform results as in other generally accepted operative procedures Therefore tendon trans-

position surgery is viewed by surgeons generally with a certain amount of distrust as there is too high a percentage of functional failures The deduction from this would appear to be that failure to secure uniformly good function is either due to faulty technique or to an inexact knowledge of the limits and indications of tendon transpositions We also note on reviewing the literature that until recently very little attention has been paid to the inner anatomy and physiology of the structures involved in tendon transpositions The pathology is fairly well established but the technique of operative procedures does not appear to have profited from it so as to avoid conditions which obviate the final success of carefully executed operations

### SURGICAL TRANSPOSITIONS OF TENDONS METHODS

Although the fact that tendons could be surgically transposed and function was known and practised as early as the middle of the 17th century yet the modern procedures date from 1880 when Nicoladoni (1) made the first deliberate transposition of a tendon for the treatment of infantile paralysis Nicoladoni's method was anastomosis of a healthy to a diseased tendon both being stripped from their peritendinous tissue It was a partial method His success encouraged





a number of imitators. In 1893 Drobnick (5) suggested and practiced the transfer of the whole healthy tendon and its direct periosteal implantation but he did not necessarily or usually make the new periosteal implantation in the old implantation site. This method was perfected by Lange (3) in 1899. Lange also used silk strands which were sutured both to the tendon end and to the periosteum to make up for deficiency in the length of the transposed tendon. This was based on some experiments by Gluck (4) as far back as 188

These two methods the anastomosis of Nicoladoni and the periosteal direct implantation of Lange are the bases of all modern surgery of tendon transpositions.

There have been many modifications. Wolff (5) made an osteal or subperiosteal bridge under which the tendon is slipped and sutured. Drobnick (2) in some cases split a healthy tendon and attached one part to the paralyzed tendon. Jones (6) also followed this method. Mueller (7) modified the bone duct excavation implantation of Wolff drawing the tendon through the completely perforated bone. This is the transosseous method. Miliken (8) introduced anastomosis by partial and reciprocal grafting of the tendons. Biesalski (9) draws the healthy tendon through the emptied sheath of the paralyzed tendon and sutures it periosteally. Vulpius (10) has been the most ardent and consistent advocate of the Nicoladoni method the technique of which he has perfected. Codavilli (11) in Italy has also been a firm follower of this method in suitable cases.

All operators have claimed successful results for the various methods advocated.

The general criticism of these methods is (a) that in all of them the healthy tendon (whether anastomosed to the diseased tendon or directly implanted in its new insertion) is first isolated from its normal anatomic surroundings and (b) that the tendon with its surrounding structures is subjected to a greater or less amount of operative traumatism (c) that but little thought is given to the importance of a tendon being reconstituted normally as regards its working surroundings or to the pathologic conditions that could and do arise as a result of the operative trauma and which interferes with the subsequent action of a transposed tendon or with its nutrition.

Many writers have called attention to the necessity of the operator having a clear conception of the anatomy and physiology of the tendon. Let us therefore briefly glance at this.

#### THE ANATOMY OF TENDON AND PERITENDINOUS TISSUES

If we take a longitudinal section of a tendon its sheath and its peritendinous tissue it will show the following structures or most of them (see Fig 1) (a) tendon itself (b) mesotenon (c) paratenon (d) plica

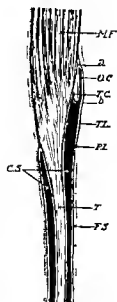


Fig. 2. Diagrammatic longitudinal section through the end of a typical synovial tendon sheath. (Modified from Lovell and Tanner.) *T* tendon *M.F.* muscle fibers *F.S.* fibrous sheath *C.S.* synovial cavity *P.L.* parietal layer of synovial membrane *T.L.* tendinous layer correspond to the epitendon *O.C.* osseofibrous cul de sac *plica duplicata* *T.C.* tendinous cul de sac *a* first reflection of parietal layer of synovial membrane—(superficial pocket of plica) *b* upward reflection of the same—deep pocket of plica

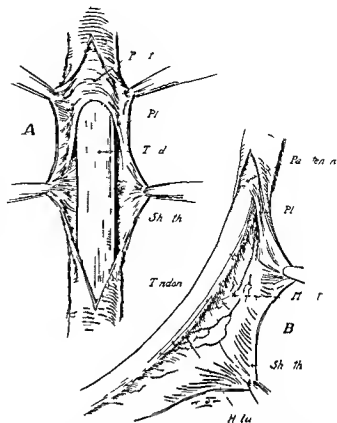


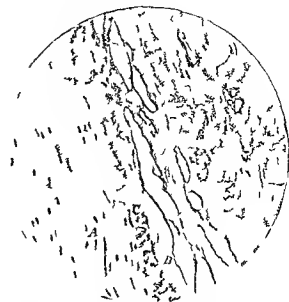
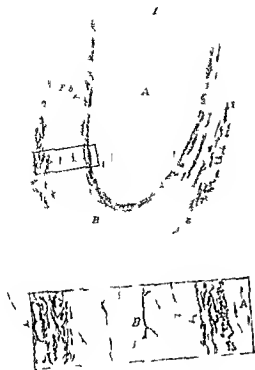
Fig. 3. Extensor longus hallucis tendon. Sheath is opened exposing the tendon and is shown the finer anatomical structure. *A* anterior view *B* lateral view showing the mesotendon and hilus

(c) the sheath (f) epitendon. The tendon proper consists of longitudinal bundles of white elastic fibers. The bundles are separated by small connective tissue septa, the endotenon or as it is often termed endoteneum internum, which is a dipping in of the outer covering layer of the tendon proper, the epitendon. The sheath is loosely applied round the tendon. It does not encircle it entirely as shown by Churmin (1) but somewhat in the same way as the visceral peritoneum covers the bowel. This sheath may be regarded as a bursa. It is generally found where a tendon changes its direction or where it passes under ligamentous structures. The inner surface of the sheath consists of a layer of cells which may be termed synovial; the outer surface consists of fibrous tissue and the two may be adherent or there may be a layer of fatty areolar tissue between the two. The sheath encloses a cavity filled with synovial fluid acting as a lubricant for the tendon gliding through this cavity as well as a fluid buffer against injury.

Lovell and Tanner (13) made a study of the tendon and the peritendinous structures in

1907. They say that the simplest conception of the vaginal synovial membranes is that they are elongated synovial sacs into which the tendon is completely invaginated a mesotendon being thus formed connecting the visceral or tendinous layer to the parietal or osseofibrous layer. The synovial sacs have an independent origin. They are often continuous either along the whole length of the sheath or at various points of it through the medium of mesotendons. A special arrangement is necessary to prevent rupture of the synovial membrane at the point where the tendinous and parietal layers become continuous at the end of the sheath. This arrangement is shown (Fig. 2) at *a* and *b* where the parietal layer of synovial membrane is twice reflected. The unattached portion of this layer gives plenty of play for the stretching or contracting of the tendon. This is the plica arrangement to which Biesalski and Mayer (14) refer in their more recent work.

When a tendon is exposed and lifted out of



F th ugh th h th a f t n f t p d t d  
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F k 4 M t f t f l t d  
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 l th ll nd th f m t f l d p fl

its sheath (Fig 3) a loose delicate connective tissue membrane is seen connecting the floor of the sheath with the tendon. This is the mesotendon. This structure is of the greatest importance, as it is through it that the blood supply reaches the epitenon and endotenon. The blood supply is seen derived from branches of the vascular supply of the muscle from the surrounding tissue as well as from branches from the vessels running in the periosteum. These blood vessels enter the mesotendon ramify anastomose and spread over the epitenon and descend along the interfascicular connective tissue (endotenon) between the tendon bundles (Fig 3). That part of the tendon in which the mesotendon is inserted is called the hilus.

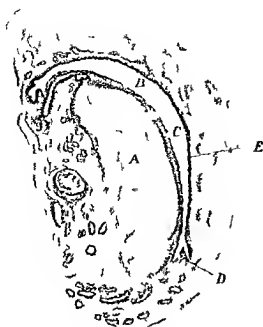
Above the level of the sheath the tendon is surrounded by loose fatty areolar connective

tissue through which the tendon glides. Mayer (15) has proposed the name paratenon. It is continuous with the paramesium of the muscle (Fig 3). This areolar tissue still envelops the tendon when it enters the tendon sheath but is soon reflected forming a fold the plica extending downward for some distance and is attached first to the tendon and then to the sheath and moving up and down and wrinkling with them. The plica at its tendinous attachment may thus be said to be continuous with the epitenon. The epitenon and paratenon structures as well as the mesotendon are highly elastic and easily stretch with each contraction and relaxation of the tendon without rupturing. They are of prime importance for the gliding mechanism of the tendon.

If a mesotendon is absent the blood supply to the tendon is carried through a fine membrane developed at the two poles of the tendon and called the vincula.

The anatomical details briefly sketched here will be found given excellently in greater detail by Lovell and Tanner (13) and Mayer (15) and the authors quoted by them. They establish the physiologic importance of the





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F l th o mm b j t T p d t d  
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Biesal ki (14) also attributes the un-  
 favorable results after tendon transplan-  
 tations to adhesions. His method of avoiding  
 them and of obtaining good function con-  
 sists in drawing the transplanted tendon  
 through the emptied sheath of the paralyzed  
 tendon.

Kirmison (18) who reviewed the results  
 and statistics published up to 1907 and who  
 has had his personal communications from  
 leading orthopedic surgeons of the world in  
 regard to tendon transplantations had that

although there was a general consensus on its  
 value yet there is a great difference of opinion  
 between those who follow the tendon to  
 tendon suture method of Nicoladoni and those  
 who prefer the periotendal tendon suture of  
 Drobnick Lange. Both schools claim the  
 best results and Kirmison thinks that the  
 question of technique ought to be definitely  
 settled. Personally Kirmison prefers the  
 periosteal method though his results have not  
 been encouraging. He thinks that the real  
 value of tendon transplantation still a matter  
 to be determined. The whole question appears  
 to be one of satisfactory technique.



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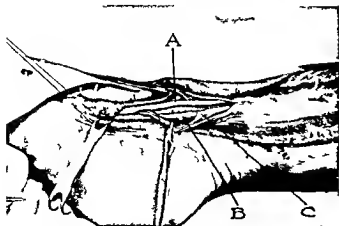


Fig. 12 Anatomical study showing the relation of the peroneal and tibial tendons in the compartment common to both tendons behind the malleolus. I peroneal tendon B peroneal sheath. Notice the reflection of the sheath with the formation of a cul-de-sac at the plica at C.

Lovett (19) writing in 1910 thinks that the operative aspect of paralysis as exemplified in tendon transference overshadows other elements of treatment and the neglect of the latter has led to a wrong conception of the operative value of tendon transference. The reason it has failed is because of unsuitably selected cases insufficient after treatment and failure to correct deformities first. Adhesions are given as one of the causes of failure of operative technique.

Steindler (20) recently writes on the necessity of re-establishing the physiological conditions not only by mechanical reconstruction of the tendon but also by absolute preservation of the nutrition of the tendon. In the

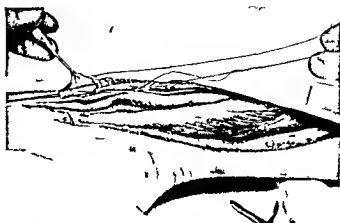


Fig. 13 Defect in sheath repaired with a continuous fine catgut suture enclosing the tendon.

handling of tendons by the usual methods much vital damage is being done. Steindler reconstructs the gliding mechanism of the tendon in accordance with the Biesalski-Mayer method but in addition he preserves the meso-tendineum as the basis of tendon nutrition. He further asserts that secondary operations performed upon patients in whom tendon transposition was performed showed the tendons to have undergone fibrosis. This we believe was due to nutritional disturbance.

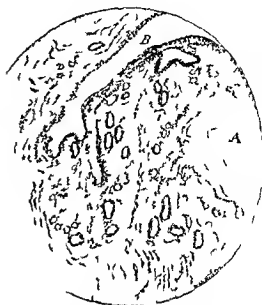
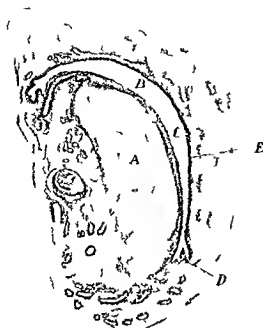
The conclusion that is fairly deducible from a study of the clinical results appears to be that there is a general consensus of opinion that tendon transposition is a practical and valuable surgical procedure but that none of the existing methods of performing it is entirely satisfactory as regards the functional



Fig. 14 Sutures inserted and peroneal tendon freed from its insertion. Notice the cul-de-sac appearing after the peroneal tendon and the amount of sheath created over the tendon.



Fig. 15 Incision in the skin over the course of the transposed peroneal tendon showing the position of the tendon in its new position.



of

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Biesiak (14) also attributes the unfavorable results after tendon transplantations to adhesions. His method of avoiding them and of obtaining good function consist in drawing the transplanted tendon through the emptied sheath of the paralyzed tendon.

Kirnisson (18) who reviewed the results and statistics published up to 1907 and who besides his personal communications from leading orthopedic surgeons of the world in regard to tendon transplantations finds that although there was a general concern on its value yet there is a great difference of opinion between those who follow the tendon to tendon suture method of Nicoladoni and those who prefer the periosteal tendon suture of Drobniak-Lunge. Both schools claim the best results and Kirnisson thinks that the question of technique ought to be definitely settled. Personally Kirnisson prefers the periosteal method though his results have not been encouraging. He thinks that the real value of tendon transplantation is still a matter to be determined. The whole question appears to be one of a satisfactory technique.

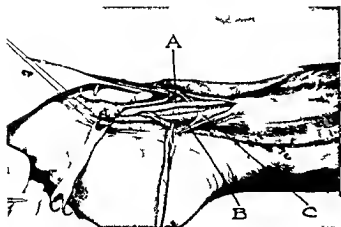


Fig. 11. Anatomical study showing the relation of the peroneus longus and brevis in the compartment common to both tendons behind the outer malleolus. A, peroneus brevis; B, peroneus longus. Notice the reflection of the lower portion of the sheath with the formation of a cul-de-sac at the plica at C.

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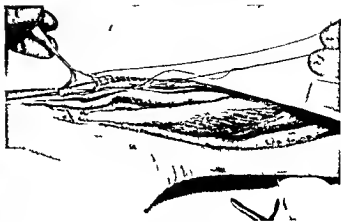


Fig. 13. Defect in sheath required with a continuous fine catgut suture encircling the tendon.

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The conclusion that is fairly deducible from a study of the clinical results appears to be that there is a general consensus of opinion that tendon transposition is a practical and valuable surgical procedure but that none of the existing methods of performing it is entirely satisfactory as regards the functional

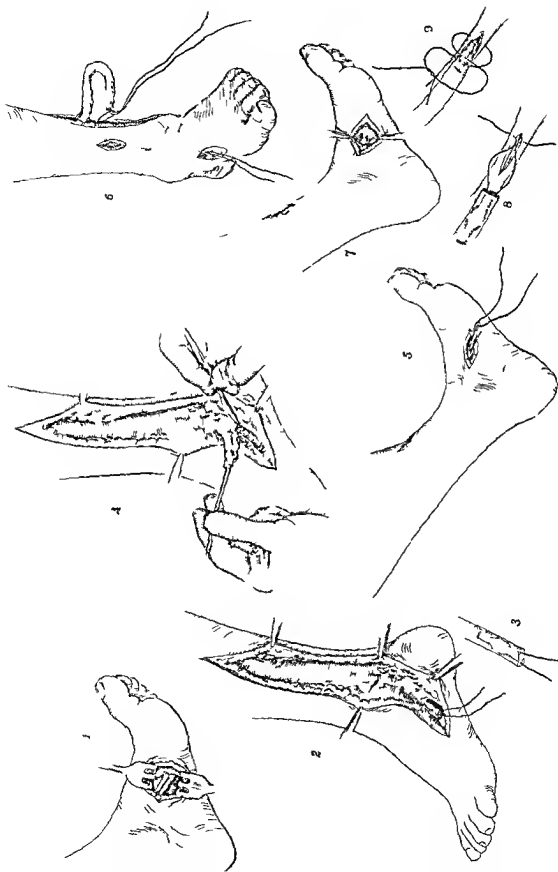


Fig. 12. Sutures inserted and peroneus longus freed from its insertion. Notice the cartilaginous appearance of the operation of sheath and the amount of slack created over with the tendon.



Fig. 14. Incision in the skin over the course of the transposed peroneus longus tendon showing the appearance of the tendon in its new position.





end results. It is also clearly seen that the occurrence of dense adhesions about the transferred tendon is one of the chief factors resulting from the operation which tends to make it a functional failure.

The questions as to the prior treatment of deformities and the postoperative treatment do not come within the scope of this paper which deals only with the operation of tendon transposition.

#### HISTOLOGICAL CHANGES OBSERVED IN THE TENDON STRUCTURES AFTER SECTION

The immediate (morphologic) changes in the tendon tissues following the section of a tendon have for a long time been the subject of experimental research. Iriogoff (21) as early as 1840 had called attention to the importance of extravasated blood in the repair process. He was followed later by Boner (22, 1957), Dembowsky (23, 1869), and others who found that there was a rapid regeneration of tendon substance and expressed the opinion that the regeneration was dependent on the blood extravasated. The early experiments of Adams (4) and Paget (5) showed that this theory was wrong and that an infiltration of blood was not only unnecessary for repair but *that it interfered with* rather than assisted the reparative process. Adams states that the rapidity and perfection of the reparative process is directly proportional to the absence of both extravasated blood and inflammation. Adams showed also that this blood was responsible for adhesions which interfered with the function of the tendons. He drew particular attention to the importance of the tendon sheath as forming the matrix of the reparative material and directing the reparative process.

The importance of the tendon sheath in the reparative process of tendon repair and function was elaborated upon by Hartmann (26), Arcoleo (27), Seggel (28), Minervini (29), Borst (30), Menciére (31), Richardson (3), Silver (33), Sover (34), and others.

Arcoleo who made a number of animal experiments regarding the value of the blood supply through the sheath in the nutrition of the tendon found that the preservation of the sheath is necessary for the nutrition of the

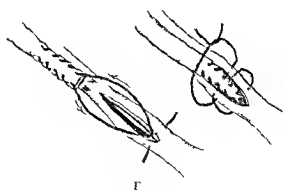
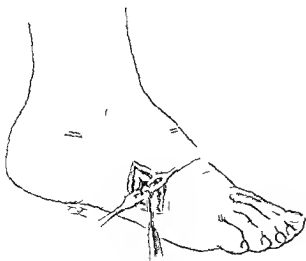
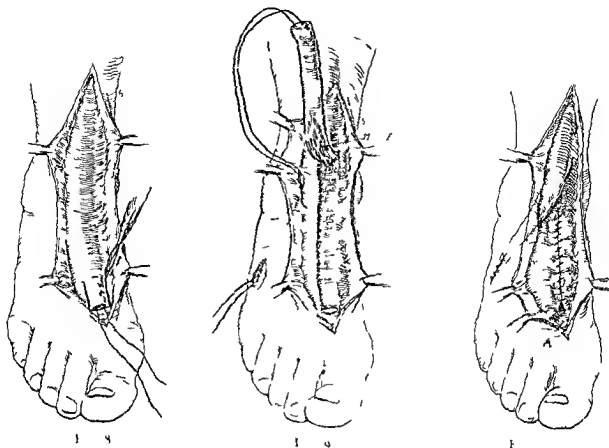
tendon. Removing the tendon from the sheath does not cause necrosis because the tendon partly derived its nutrition from the lymphatics.

Borst found that the repair of tendons was due to the emigration of leucocytes and proliferation of polyblast cells from the adjacent connective tissue. There was also a participation of true tendon cells.

Seggel's experiments showed that regeneration between the sutured ends of a tendon was much more rapid where the tendon sheath had been left intact. The sheath and adjacent connective tissues as well as the peritendineum externum and internum all contribute. Marchand (35) thinks that there are two processes: cicatrization and tendonization of the scar tissue.

Minervini studied all the literature on tendon regeneration up to 1903 and made independent experimental researches in the University of Genoa. His experiments comprised partial and complete tendon resections with separation of the stump and plastic operations to repair extensive losses of substance. From his own results and the findings of others, Minervini found that immediately in the focus of the lesion and in the sheath there was hæmorrhage which coagulated at once. Soon round migrating elements and young proliferating cells infiltrated this coagulum which after 3 to 5 days is transformed into germinal or formative tissue and then into young cicatricial tissue which successively became fibrous. Adhesions to the sheath and to the integument which in the first days after the lesion was large became circumscribed with a tendency to lessen.

Soon after the lesion there is noted a general and diffuse reaction in the tendon in the sheath and in the circumscribed tissues consisting in vascular disturbances clearly visible 1 hour after—hyperæmia, congestion, migration of leucocytes and general proliferative activity. These processes reach their maximum by the third day. The endothelia of the tendon and of the sheath are among the first elements to proliferate. The fixed elements of the sheath and the connective tissue surrounding the tendon participate in this inflammatory re-



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action. The process extends along the interfascicular septa and finally involves the tendon proper.

All the neoformed elements congregate in the lesion focus and invade the coagulum transforming it. Germinal tissue is rapidly organized and the young cells assume the shape of fibroblasts. The first neoformed capillaries have formed an evident network by the sixth to the eighth day. The tissue has taken on the form of a cicatrix. This tendon cicatrix does not show any traces of elastic fibers nor is the development of nerve fibers evident. The abundance of blood shed in the focus at first forms a kind of hematoma and hinders and delays the process of repair. In tendon plastics the process of the regeneration is the same but slower. The germinal tissue is successively transformed into cicatrix and the progressive evolution up to the hundredth day is very similar if not identical with the tendon in structure. Adhesions of the tendon scar with the sheath and with the neighboring tendon very extensive in the beginning slow up in time. Cellular tissue alone finally remains which allows the tendon to slide. In the process of repair it is observed that the sheath is ordinarily very active in partial resections and this activity increases as the distance between the tendon stump increases. Regeneration takes place in both tendon stumps in the central end more intense in the peripheral more early and active. The germinal tissue which gives place to the scar is drawn rather from the *tendon stumps* than from the sheath and surrounding tissues it is easily seen that the adhesions of the scar tissue to the sheath are very close and as a result the scar is long and subtle.

The researches of Menciere (31) Anzilotti (36) and Sever (34) tend further to establish the fact that when a tendon regenerates without the presence of a sheath the neoformed tissue is fibrous that in fact the presence of a sheath and peritendineum are necessary in order that true tendon tissue should be regenerated. Lange had previously found similar results. Sever especially showed that when these structures were present and functionated early adhesions were absent.

Guaccero (37) also found experimentally that when the sheath was removed from a tendon the regeneration was fibrous.

Richardson's (32) experimental work as well as Minervini's confirmed the earlier work of Adams as regards extravasated blood interfering with healing and causing adhesions between the tendon and its sheath. He also found that it was most important that the tendon sheath and peritendinous tissues should be left as nearly intact as possible to prevent interference with tendon motion.

The researches of Silver (33) showed that when a reinforcing tendon is separated from its sheath and peritendineum in a transplantation its function is interfered with by loss of nutrition.

Consideration of these experimental findings makes it quite clear that the function of a surgically transposed tendon *separated from its normal surrounding structures* is interfered with (1) by disturbances of its nutrition (2) by mechanical obstructions to its motion (3) by adhesions (4) by a change in the nature of its regenerated tissue. As a corollary it would seem that the true physiological method of transferring the function of a tendon to a new insertion is to transpose it *with all its necessary peritendinous structures and with the minimum amount of surgical traumatism*.

Having now given an outline of the present status of tendon transposition surgical procedures and their results I will pass to the special experimental work the findings of which I desire to report.

#### EXPERIMENTAL RESEARCH ON VARIOUS MODES OF TRANSPOSING TENDONS

The experimental work carried out at the Northwestern University Medical School was done with a view of determining the relations of the sheath to the tendon from a surgical standpoint. The experiments were divided into three series of tendon transpositions in dogs.

*Series 1* ( experiments). A tendon was sectioned at its insertion lifted out of its sheath and surrounding tissues and transposed through the subcutaneous tissue into a

new periosteal insertion. This is the Lange periosteal method.

*Series* (8 experiments). A tendon was sectioned and isolated as above and transposed to its new insertion *through the sheath of another tendon*. This is the Bieszkki-Mayer so called physiological method.

*Series 3* (10 experiments). A tendon was sectioned at its insertion and transposed to *gether with its sheath and peritendinous tissue*. This is the author's method of transposition.

In executing these experiments the strictest surgical precautions were observed both as regards asepsis and the avoidance of unnecessary traumatism.

In my own method (*Series 3*) of transposing the tendon with the sheath and the peritendinous tissues a special technique is adopted. After incision of the skin and superficial fascia the skin is retracted and the tendon in its sheath exposed to view. *The tendon sheath is not opened*. Where two tendons occupy the same sheath as much of the sheath is carried over with the transposed tendon as is necessary to repair the defect. This is illustrated in Figures 11, 12 and 13 in the transposition of the peroneus longus. Special fixation sutures (Fig. 22) are introduced at the point where the tendon is to be cut. After inserting the fixation sutures an incision is carried laterally on both sides of the tendon for about one fourth inch (Fig. 6) and the tendon severed. The tendon still in its sheath is carefully raised by means of the fixation sutures, the special object being to avoid all possible trauma by handling etc. and a scissors cuts *through the peritendinous tissue only* on each side of the tendon (Fig. 15). The isolation of the tendon is carried to the lower muscle fibers. A probe is now introduced along the paralyzed muscle taking into account the special anatomical relation of the septum which separates the adjacent muscles. In the fascial planes the probe is then carried under the ligamentary structures as for instance the annular ligament and brought out at the new implantation site. The fixation suture is now attached to the eye probe and carried down through the new canal. The transposed tendon is fixed in its new implantation. Throughout this entire opera-

tion the tendon is protected by its own normal coverings.

The period of immobilization varied from 8 to 21 days after operation. Microscopic sections were prepared from different levels of the tendon and the histological changes noted. In some cases the tendon was allowed to remain unattached. This was done to determine the viability of the sheath after transposition and was not intended to re-establish the function of the tendon.

The results found after these experiments were as follows:

*Series 1*. After 1 day's the transposed tendon was deeply embedded in a granulating and infiltrating area. Microscopic sections at different levels showed marked leucocytic infiltration around the tendon bundles and penetrating along the endotenon into the tendon substance. Some degenerative changes were shown in the tendon as evidenced by a poor staining reaction of the nuclei. The greatest amount of proliferation and infiltration took place in the epitenon and surrounding tissues, viz. a large number of leucocytes invading the structures surrounding the tendon with marked proliferation of the epitenon and numerous small new blood vessels giving rise to the characteristic picture of granulating tissue.

*Series*. In the experimental transposition of tendons through the sheath of another tendon (the Bieszkki-Mayer method) the histological findings were very characteristic. Figure 4, microscopic section from a case of 1 day's standing and Figure 5, one of two weeks' duration show the tendon cell in an almost unchanged state, a few cells showing a slight inflammatory condition. The sheath wall proliferated markedly, a marked leucocytic infiltration is evident. New blood vessels are evident and filled with red blood corpuscles and leucocytes. In the sheath fibrous adhesions are found extending from the tendon to the sheath wall and in places becoming incorporated with the sheath wall.

*Series 3*. Figure 7 is a 21 day cross section through the extensor longus hallucis of a dog operated upon by my method and Figures 8 and 9 are specimens of two weeks' duration showing the following: (a) tendon (b) sheath

(c) plica duplicata (d) epitendon (e) endotendon The tendon appears clear and unchanged. The sheath is clear in spite of infection which has taken place around the transposed tissue. The parietal surface of the sheath shows a leucocytic infiltration with many mitotic changes. The basement membrane cells show a proliferation but no breaking down into the sheath itself. Numerous young blood vessels are visible and the process is clearly in the stage of regression (Fig. 9). The plica is thickened but no breaking down of cell structures is discernible. The epitendon remains unimpaired as does the endotendon.

#### DISCUSSION OF EXPERIMENTAL FINDINGS

*Series 1.* The proliferative and infiltrative changes observed when an exposed tendon is transposed directly to a new insertion would lead one to believe that these changes are permanent and although not marked enough to destroy the vitality are such as might interfere with the functioning of the tendon.

The extensive inflammatory reaction found around the tendon is only what may be expected seeing that the tendon covering (epitendon) is synovial in character. When this tissue is placed subcutaneously in a traumatized area it responds extensively to inflammatory changes. It is impossible to conceive how a tissue so specialized as the peritendineum externum could remain uninvaded even under slight operative traumatism; this is intensified because the tendon itself has a comparatively poor blood supply and it is removed from part of this its normal source of nutrition i. e. from the peritendinous tissue and mesotendon. The adhesions are greater because the tendon must re-establish its circulation from some other source. Lewis and Davis (38) state that when a tendon is transposed into subcutaneous fat an infiltration takes place as well as proliferation referable to the epitendon and endotendon; there is also oedema probably due to imperfect restoration of the circulation.

Even when the tendon is transposed with its sheath it appears that the greatest proliferation takes place in the sheath wall as it is the characteristic of all synovial tissue to respond to stimuli by a proliferative

and exudative reaction. Transposing a tendon to a new insertion stripped of all its surrounding tissues therefore appears to be unphysiologic because (1) it deprives a tendon of its nourishment and (2) it exposes a susceptible tissue to irritation and thence to the formation of adhesions.

*Series 2.* In discussing the findings in these experiments in which the tendon was transposed through the sheath of another tendon we must recall the anatomical relation of the tendon to the sheath and the technique of the operation in order that we may be better able to interpret the pathologic sequence. In this method the tendon sheath is opened and the tendon severed from its surrounding tissue (mesotendon etc.). Sutures are inserted in the distal end. This forms a more or less thick rough stump. The tendon is now forced through the sheath of the paralyzed tendon. It is obvious that such an operation cannot be performed without some injury both to the tendon covering and to the new sheath. The delicate epitendon is irritated and lacerated in places; there is a similar trauma of the sheath wall due to the rubbing of the tendon stump as it passes through this new canal. Referring back to the anatomical structure of the sheath (Figs. 1 and 3) it is seen that it is attached to the surface of the tendon (Fig. 3, mesotendon plica). This connection must of necessity be torn in this technique. The plica as already noted is of special importance for the gliding action of the tendon. In order to expose and transplant the tendon all the fine anatomical points which the advocates of this method have employed must be sacrificed. The mesotendon which structure is of prime importance for the nutrition of the tendon is cut in order to free the tendon from its sheath. The pathologic effects of these traumatizing actions are seen in the inflammatory results which follow this procedure. The sheath becomes congested and as a result an increased amount of blood is brought to its surface. There results therefore an exudate of serum into the sheath with an infiltration of the sheath wall and surrounding tissue. The sheath wall may break down and the inflammatory products find their way along the interfascicular connective tissue

Thus we see a fibrinous exudate in the sheath cavity the meshes of which contain synovial cells blood cells and leucocytes the pathologic picture resembling that of a tendovaginitis. When early motion is permitted after this operation the irritation produced by the constant playing of the tendon causes the reaction to continue. Such an effect is a contra-indication therefore for early active motion which is a desideratum in this operation. The further progress which may be observed takes two courses (1) an absorption of the products of the inflammatory reaction and (2) organization with fibrous tissue formation. Adhesions when they occur are a result of incomplete absorption of inflammatory products and it is seen from Figures 4 5 and 6 that adhesions do take place. And although these adhesions become elongated by the constant play of the tendon they still limit its motion. There are two types of adhesions here as elsewhere in synovial structures they are at first fibrinous and elastic and later become fibrous and firm. Figure 6 is taken from Mayer. One can see that in the cavity of the sheath are delicate connective tissue strands the result of slight trauma incidental to the operation. He Mayer is of the opinion that they are sufficiently elastic not to impede the free gliding of the tendon. But it must be acknowledged with all respect to Mayer's method that if we are to accept an operative method it must fulfill the purpose for which it was intended and if adhesions do form after this method the result defeats its purpose.

The final results obtained therefore by transposing a tendon through the sheath of another tendon while an improvement on the older methods of direct transposition cannot be considered as entitling this method to be physiologic as claimed for it.

**Series 3.** Very little comment is necessary as the results in this series are shown by the histologic findings. Figures 8 and 9 speak for themselves. The central fact is the absence of all inflammatory processes between the tendon and the sheath and further there is no opportunity for the occurrence of adhesions. The epitendon and endotenon remain unimpaired. Such reaction as is observed has

very little effect on the functional action of the transposed tendon.

The second important fact observed here is that this method of transposition avoids the possibility of fibrosis of the tendon a condition which was observed in other methods. This fibrosis is a nutritional disturbance of the tendon and is brought about by separating the tendon from its blood supply *mesotenon* and its surrounding connective tissue structures.

Kirschner (39) does not believe that the epitendon possesses the reparative properties that the periosteum has. Richardson (3) is of the opposite view. The marked proliferative and infiltrative change which takes place along the septa strengthen one in the belief that Richardson is correct and this view is in accordance with the experimental findings of other observers (Borst Minervini etc.). In inflammatory processes the tendon parenchyma is passive the inflammation however extends along the interfascicular connective tissue which carry blood vessels (peritendinum internum endotenon Fig 10). The infiltration which follows extends along interfascicular connective tissue causing permanent fibrous changes. This accounts for the fibrosis of the tendon observed by many authors after direct transplantation especially when the peritendinous structures were disregarded. It is obvious that when the peritendinous structures are transposed with the tendon such fibrosis cannot occur and experimentally it is so found.

This method of transposing a tendon preserving with it its normal anatomical surroundings and obtaining results by which the tendon in its new position fulfill its normal functions is therefore claimed as the true physiological method of transposing tendons.

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## GUNSHOT FRACTURE OF THE FEMUR

By J. K. BUCHHEIDER, M.D., Ch. Co.  
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**F**RACTURE of the femur ranks first in so far as difficulty in treatment is concerned. Because of the relatively large size of the thigh it is impossible except by open operation to obtain and maintain reduction with the same ease and accuracy as can be secured in fractures of the smaller extremities. More frequently than in any other type of fracture the end results in our femur cases have been accompanied by some degree of permanent disability.

The man whose opportunity it has been to control the treatment of gunshot fracture of the femur subsequent to arrival at the base will agree that no septic wound is more difficult to control than a deep intermuscular phlegmon of the thigh particularly when caused by high explosive shell or shrapnel fragments. It is to the details of treatment of this type of fracture and to the exposition of a simple and highly efficient method of standardizing the treatment that I wish to write.

We must systematically begin the treatment of such fractures with several very definite objects in view, namely: immediate reduction and fixation; the earliest possible control of wound infection; ease of access to the thigh at all times for inspection and palpation; repeated X-ray control until bony union has occurred; a means easily of moving the patient without disturbing the fracture; and early and constant mobilization of the knee joint.

It should be a cardinal rule that every fracture regardless of its type or location be reduced as quickly as possible and permanent fixation applied. Malposition of the fragments of a fracture traumatizes the soft tissues. This trauma within 48 to 72 hours manifests itself by edema, by infiltration and by a loss of the normal elasticity which adds difficulties to the reduction. In compound fractures this additional trauma to the soft tissues is frequently responsible for the further spread of infection.

There are two methods of immobilizing the fragments of any fracture. The first is traction; the second, some type of fixation splint or open operation. Overriding is an almost constant accompaniment of these fractures; neither plaster nor splints will correct this. Primary use of the Lane plate would certainly invite infection in the majority of cases. The chief indication for this method I believe is in those cases in which non-union occurs and in which all wounds have completely healed. In cases suffering an active infection the use of a plate is out of the question.

The latter of Paris has a very limited field in the treatment of any compound fracture of the femur. It is useful only in those fractures in the vicinity of the trochanter where there is no wound of consequence to care for where there is no overriding and where loss of abduction is the only deformity to be feared. Where there is any question of infection plaster prevents that easy access for inspection to all part of the thigh that is so necessary as long as an open wound remains.

We come now to method of extension which most certainly is the method of choice in nearly all compound fractures of the femur.

Buck's extension, its principle embodying the use of adhesive strips upon the skin upon which traction is made by means of weights and pulleys, is of course the method most commonly used. It is easily applied; is relatively comfortable; and in many cases it reduces the overriding particularly in simple fractures. But there are a number of serious drawbacks to the routine use of Buck's extension.

First of all it is not an infrequent occurrence to discover that no amount of pull that can be safely exerted upon a Buck's apparatus will be sufficient to correct the overriding. We have made this observation by means of the X-ray upon fractures that had been under continuous traction for two weeks or more. This is due to the fact that much of the

pull does not reach the distal fragment of the femur, because it is lost in the intervening mass of thigh muscles. Fractures of the lower third are particularly hard to handle by this method because sufficient hold can not be obtained upon the lower fragment. For this reason it is often difficult to avoid undue pull upon the knee joint in these cases and one of the most disagreeable complications of a fracture near the knee is a stiff joint.

There is another serious objection to the use of adhesive for a compound fracture. While the wounds are open it is often difficult to get enough sound skin to get a good purchase. Adhesive obscures too much of the thigh. Its presence near an open wound particularly if suppurating is often very uncomfortable.

As a method of traction, the Steinman pin or so called nail extension offers an almost ideal means comfortably and safely of maintaining accurate apposition. The original method consists of driving a nail one eighth of an inch thick and some eight inches long through the condyles of the femur and making traction from the projecting ends. A more satisfactory modification consists of the use of the saw tongs or caliper in which the nail on each side is driven merely through the compact bone of the condyles. The technique is as follows:

When it is not necessary to do other operative work upon the thigh requiring a general anesthesia the caliper may be attached under local anesthesia. The site chosen is the most superficial point of the condyle on each side. A knife puncture down to the periosteum is made the points of the caliper inserted and then hammered into the bone about one fourth of an inch. Care must be taken to avoid the knee joint. A caliper with an adjustable set screw that prevents the points of the nail burrowing further is advisable. The thigh is now ready for traction. This method of extension has the following advantages:

Traction upon the distal fragment is absolutely certain regardless of its length. Reduction is maintained with considerably less weight than is possible with adhesive. The entire leg and thigh are free from any other incumbrances necessary for traction.

The thigh is readily held clear of the bed so as freely to expose the entire posterior surface without a supporting splint or counter traction. The patient is entirely free from any discomfort due either to traction or to the wounds made by the nail punctures. These wounds when made through a clean area do not become infected.

There are two advantages in the use of the nail extension that are worthy of special mention. Permanent partial disability due to a stiff knee is of frequent occurrence following femur fractures and probably the most common cause is an improperly applied Buck's extension. Continuous traction upon a normal joint will almost invariably produce a partial ankylosis. Furthermore it is impossible in fractures close to the knee to avoid excessive traction upon the joint when a Buck's extension is used. Moreover simple immobilization of the knee often causes more disability than the fracture.

The use of the nail extension leaves the knee comfortably mobile from the moment of its application. It has been our custom to apply to the foot of the injured side a plaster shoe extending just above the ankle. A rope imbedded in the dorsum of the shoe leads upward over a pulley and then down to within easy reach of the patient's hand. The shoe prevents foot drop by means of the rope he is able easily and frequently to flex and extend the knee. A most surprising feature of this procedure is its absolute painlessness and it assures a joint with a full range of motion when bony union has occurred.

The second advantage of the method is its permanency for the particular fracture to which it is applied. It requires no change until a fair degree of union has occurred. A secondary operation for overlooked foreign bodies for further drainage or other cause does not necessitate the removal of or interference with extension.

We come now to the description of an adjunct to the above technique namely a method that makes the patient independent of his bed without disturbing his fracture. And if I seem to burden my description with unnecessary detail it will have been more than worth while if I succeed in emphasizing

the necessity of these details. It is strict attention to minutiae in these cases that minimizes wound complications, promotes a comfortable convalescence which at best is long and tedious, and most important prevents deformity.

In 1906 H. M. Richter suggested the use of a frame constructed of gas-pipe similar in principle to the Bradford frame for the treatment of fractures of the femur in children. The apparatus consists of a rectangular frame of gas pipe corresponding in size to the margins of the bed. A Balkan frame of the same pipe is attached to each end of the rectangle by means of a sliding collar. The rectangle is covered by two pieces of canvas securely fastened to the sides and separated in the center by enough space to allow easy access to the buttocks when the frame is lifted from the bed. The patient lies upon this frame, the canvas being covered except for the space in the center by sheets. Traction ropes from the nail extension are carried to pull and fastened to projecting arm pieces.

Once so suspended the patient may be lifted from the bed, washed, placed upon a bed pan, removed to the X-ray or operating room without disturbing the relation of the fragments of his fracture and without causing him pain. Confronted suddenly one night with ten suppurating compound fractures of the femur we were quickly impressed by the necessity of having easy access to every wound during the time that the limb was in extension. After a preliminary trial with five or six cases every femur fracture thereafter was transferred to a frame as soon as possible after his arrival at the base.

We come now to the treatment of the wounds in these cases, a simple thing to describe very often a most difficult feat successfully to accomplish. The present status of the treatment of soiled wounds may be summed up in a few words. Wherever possible wound excision and primary closure is the method of choice and is successful in more than 75 per cent of all cases. Vital structures, very extensive wounds and poor operating facilities make excision impossible or dangerous. In these cases chemical sterilization makes possible in six to ten days a

secondary closure that is practically equal in results to primary closure. It is in the latter class that Dakin's chloramine preparations find their greatest field of usefulness.

Thigh wounds offer special obstacles to the application of the technical details of these two methods of treatment. The large size of the thigh, the many fascial septa and above all the great muscle mass are the chief causes of the difficulties.

The shattered femur causes an immediate shortening, which makes it difficult to follow the path of the projectile. Moreover comminution is the rule and it is a common occurrence to find fragments of bone several inches away from the site of the fracture. In addition of course a bullet or several shell fragments carrying with them clothing, skin or other foreign material are imbedded in the muscles at various levels.

The choice of treatment therefore depends upon the type and location of the wounds of entrance and of exit. Where a complete excision of all contaminated and bruised tissue is possible, this method followed by immediate closure is the ideal treatment. But there seems to be a general unanimity of opinion as to the danger of closing such a wound that has not been explored to the complete satisfaction of the surgeon. A deep focus of infection spreads insidiously and rapidly during transportation; close observation is usually not possible and the patient arrives at the base with a serious intramuscular phlegmon.

The many layers of large muscles make irrigation and drainage difficult. The safest procedure in wounds left open for chemical sterilization consists in cutting transversely muscle and fascia so as to allow a gaping wound that does not tend spontaneously to close. This allows easy access to all recesses of the wound and prevents interference with drainage by the accidental overlapping of fascial or muscle layers.

The serious complications that may attend the injuries must be mentioned because of the frequency with which they occur and because of the keen judgment and prompt execution of treatment with which they must be met.

Secondary hemorrhage in a compound fracture of the femur is a most dangerous complication because of the frequency with which large vessels are involved and because of the rapidity with which such a hemorrhage may prove fatal. They invariably occur about some focus of uncontrolled infection. Control of infection and proximal ligation are necessary to prevent recurrence which is certain otherwise to follow. Repeated hemorrhages will very often require amputation.

Suppurative involvement of the hip or knee joint are serious and require an early diagnosis. Possibility of invasion of the hip should always be thought of when an intra-capsular fracture is found. A peri-articular infection from a shattering fracture near the condyles may ultimately invade the knee joint in spite of every precaution. In the case of the hip excision of the head of the femur is necessary to allow access to all of the infected joint. In the case of the knee it would be easy with the thigh maintained in extension by means of a caliper extension to carry out the method of early mobilization practiced by Willems. But a severe sepsis that does not quickly respond to drainage and chemical sterilization properly carried out re-

quires amputation to save the patient when amputation is done too late mortality is high.

#### SUMMARY

Immediate and continuous immobilization lessens the likelihood of sepsis.

The caliper modification of the nail extension is a particularly valuable method of reduction because

It is far more dependable in its extension and with less weight than a Buck's extension.

It permits complete exposure and opportunity for inspection of the thigh at all times.

It permits as does no other method early and continuous mobilization of the knee joint. It is more comfortable to the patient.

The frame above described is an indispensable adjunct in all femur fractures treated by any method of traction because without disturbing the relative position of the fragments throughout the period of convalescence—

The patient is made independent of his bed.

Frequent X-ray control is easy.

The care of an otherwise difficult soft tissue injury is made relatively easy.

Finally the thigh must be inspected frequently because of the possibility of recurring infection.

# DEPARTMENT OF TECHNIQUE

## DEVICES USEFUL IN FRACTURE WORK

By MAJOR JOHN J. CANADAY, M. I. A. C. R. U. S. A.  
B. S. C. H. I. C. M. H. M.

FOR the past three years in the treatment of fracture I have made frequent use of the following described devices the first two of which may be purchased from any hardware store.

1. Caliper to know the proper length for the bone transplants.

2. Divider such as are used by engineer. These are most useful in finding the diameter of the marrow cavity in the fractured end of the bone in order that the intramedullary bone dowel may be properly shaped so as to secure an exact fit. These dividers have a set screw by which it is possible to secure the point in any desired position.

3. A wooden spreader of proper length to separate the thigh and hold them firmly in

a position of abduction when a plaster cast is being applied in the treatment of fracture of the neck of the femur or of fracture near the trochanter.

In the treatment of such a case I usually apply a plaster cast including the foot, leg, thigh and pelvis of the fractured side. This cast also includes the trunk as far upward as the episternum and the opposite thigh to the knee. Early in the process of applying this cast several extra turns of plaster bandage are applied around each of the thighs just above the knee. The inner side of each thigh having been previously well protected against possible pressure at that point. The remainder of the cast is finished in the usual manner. A light wooden spreader made of a piece of board about four inches wide and about three fourths of an inch in thickness, the end cut concave so as to fit the curvature of the cast is placed between the thighs a short distance above the knee and is securely anchored in position by a few turns of plaster bandage applied alternately to the spreader and to the thigh. This spreader is obviously helpful and is easily cut to suit the amount of abduction desired.

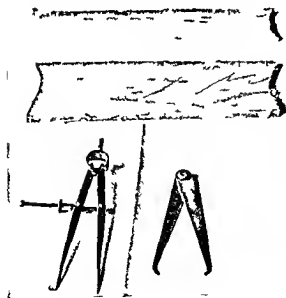


Fig. Caliper, divider, spreader



Fig. Spreader effect of the neck of the femur

## INTRINSIC TRIFID OR DOUBLE HOUR-GLASS STOMACH

F. A. MAJOI JOSEPH BURKE M. C. U. S. A.

S. G. S. I. S. Hospital Buffalo, N. Y.

THE recent very interesting article by Carman concerning hour glass stomach has stimulated me to add a very unusual case to the literature of intrinsic hour glass stomach a case of true trifid or trilobular stomach due to chronic ulcers which I recently operated upon at Sisters Hospital Buffalo New York.

In his article Carman refers to a case of trifid stomach observed in 1899 and reported by Mayo Robson in 1904 but Mayo Robson's was a case of partial extrinsic origin. According to Mayo Robson's own description as published in the *London Lancet* his case was not a true intrinsic trifid stomach due to ulcer. The stomach was divided into three (3) portions the proximal narrowing being dependent on a band of adhesions extending from the liver to the transverse colon and the distal constriction being caused by cicatrization of a chronic ulcer. The first cavity was divided into two by the firm band leaving the middle loculus of the stomach the smallest of the three cavities and the cardiac pouch the largest. Mayo Robson divided the firm band of adhesions forming the first constriction and on opening the second stricture a chronic ulcer was exposed and the channel was so narrow that it would only allow the passage of a No. 12 catheter. Gas troplasty was performed one of the largest size decalcified bone bobbins being used.

In my own case I will show a true intrinsic trilobular stomach due to cicatricial contraction

of chronic gastric ulcers and as far as I can determine from a perusal of the literature it is the only genuine intrinsic double hour glass stomach ever reported.

Miss M. B. single age Dr. Allen Jones who examined the patient kindly permitted me to use his case history to be incorporated in this report. I wish to extend my sincere thanks to Dr. Jones for his courtesy and interest in the case.

History: Ten years ago the patient had indigestion and since that has had periods of stomach trouble. In January he began to have trouble and for three months he had had severe pain in the stomach at times then she experienced a period of considerable relief.

For the past two or three months she has complained a great deal of hunger distress. Her appetite is poor. She occasionally vomits but she has vomited no macroscopic blood. She is extremely tender just to the right of the umbilicus. There is a tenderness in the lower portion of the abdomen on both sides above the pubes. She is very constipated.

Examination of the stomach content			
Color	normal	Lactic acid	absent
Odor	no mal	Rennin	present
Mucus	slight	Biuret	present
Total acidity	44	Propeptone	present
HCl	28-100	Peptones	present
Acid salts	9	O ganic acid	absent
C. ml in d. chloides	8	Tube	25
Amount	100 cc		

Test meal—bread and water  
Withdrawn one hour after eating.  
Macroscopic appearance—well digested contents  
Occult blood—negative

The bucket attached to the thread did not go through into the duodenum. There was no blood stain on the thread. The contents of the bucket were acid.

Wassermann negative



Fig. 1 Taken 10 minutes after ingestion of opaque meal

Fig. 3 Roentgenogram 3 hours after ingestion of opaque meal

Fig. 2 Same as Fig. 1

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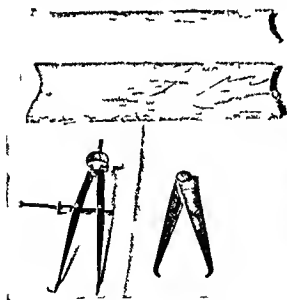


Fig. 1. Calipers. Fig. 2. Dividers.

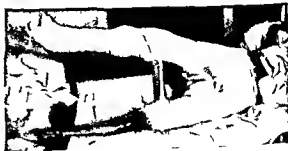


Fig. 3. Effect of the neck of the femur.

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For the past two or three months she has complained of a great deal of hunger distress. Her appetite is poor. She occasionally vomits but she has vomited no menses or blood. She is very tender just to the right of the umbilicus. There is a tenderness in the lower portion of the abdomen on both sides above the pubes. She is erythrocytic stippled.

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Mucus	slight	Biuret	present
Total acidity	44	Proteptones	present
HCl	4 to 6%	Peptones	present
Acid salts	8	Organic acid	absent
Combined chloride	8	Tube	75
Amunt	00 cc		

Test meal — bread and water  
Withdrawn one hour after eating  
Macroscopic appearance — well digested contents  
Occult blood — negative

The bucket attached to the thread did not go through into the duodenum. There was no bile stain on the thread. The contents of the bucket were acid.

Wassermann negative



Fig 1 Taken 20 minute after ingestion of opaque material  
Fig 2 Same as Fig 1



Fig 3 10 nitrogenous hours after ingestion of opaque material





There was very little reaction after the operation once only did the patient vomit a small quantity of blood. The conalescence was uninterrupted. On the fourth day after operation the patient, as taking soft foods without distress. The patient now is able to eat everything with no gastric complaint.

Koentgen's examination (Dr. LeVyn) twenty-three days after operation reveals an excellently functioning stom-

ach. The opaque meal passes from the cardiac end through a perfectly patulous orifice at the site of the gastro-gastrostomy to the gastro-entostomized opening and is ejected rapidly into the jejunum (Fig. 6).

None of the bariumized meal passes the pylorus.

Six-hour examination shows no gastric residue and the column has advanced through the colon almost to the hepatic flexure (Fig. 7).

## SOME POINTS IN SURGERY OF THE EXTERNAL CAROTID ARTERY

By WILLIAM PERRIN NICOLSON, M.D., F.A.C.S., ATLANTA, GEORGIA

**A** GLANCE at the literature of surgery would reveal the fact that while ligation of the larger vessels has been somewhat fully described there is little in reference to ligation of the external carotid and the writer feels that a somewhat extended experience with operations upon this vessel may be presented with some interest and profit.

When we consider the anatomical arrangement of the vessels of the neck and study their distribution we can but reach the conclusion that Nature has so distributed the circulation as to extend to us an invitation to utilize this most valuable means of producing a temporary ischemia in operations involving this region. The subclavian supplies the lower portion of the neck. The common carotid divides into two branches the external and the internal the external supplying the blood to the extracranial structures while the internal carotid without giving off a branch enters the skull supplying the intracranial structures. The only exception to this distribution is the middle meningeal which enters the skull from the external carotid. For many years ligation of this vessel was not considered possible for when the ligature came away there was not space enough between the branches for a thrombus to form and secondary hemorrhage was almost a certainty. Hence the surgery of this vessel became possible with the finding of a ligature that remains in place.

On May 21, 1891, in the earlier years of my surgical work I was called upon to remove my first upper jaw and the current descriptions of the technique of such operations gave a gloomy picture of hemorrhage, shock and death. It occurred to me at this time that a preliminary ligation of the external carotid might check hemorrhage and simplify the operation. My patient was in the country and could not be removed to the city because her baby was only 8 days old and operation could not be delayed for the sarcomatous tumor was growing with great

rapidity. The patient was removed from her bed to the operating table. After some difficulty, due to natural timidity, the vessel was tied with No. 2 catgut ligature and the wound closed. The first incision in the face bled so freely that it appeared as if some mistake had been made but the hemorrhage soon ceased and the jaw was removed successfully without tying another artery. A report of this case was published in the *Atlanta Medical and Surgical Journal* and afterward abstracted by Dr. Matas in Davis's *Medical Annual* and from this starting point as far as I know began the deliberate ligation of the external carotid for the purpose of controlling hemorrhage. Since that time a large experience has forced upon me the conviction that this procedure has not been appreciated by the surgical profession.

It is a notable fact that all operations upon the head and face are by force of circumstances bloody and when the operation involves an opening into the mouth there is the added danger of blood finding its way into the air passages. We even find at this day recommendations for preliminary tracheotomy and pharyngeal plugging. Ligation of the external carotid absolutely controls all serious hemorrhage shortens the operation prevents shock and places the operation upon a plane within the reach of any surgeon.

The first question that naturally arises in regard to procedure is that of the danger incident to the operation. So far in my experience I can pronounce it *nil*. I have tied the artery more than a hundred times. Four times both external carotids were tied at the same operation twice a common carotid at one side and external upon the other eight Dr. W. B. resections of the entire external carotid upon both sides with an interval of a week between and eighty-two single ligations for the purpose of controlling hemorrhage. In no case has there been a death. This I believe should establish the fact that the

operation is safe. In a discussion of the Crile operation of carotid compression I advanced the idea that ligation is safer in the average hands. Dr. Crile replied that he believed the mortality of external carotid ligation would be as much as 1 per cent from embolism. Since that time the textbooks have it that Crile says the mortality of external carotid ligation is 1 per cent which shows the weight of the thoughts of a great man.

It is my purpose to mention some of the conditions in which ligation has been clinically exceedingly useful to me. In the first place in any operation about the face or neck in which hemorrhage may become a serious factor it simplifies the work wonderfully. It does not prevent bleeding but makes it controllable without ligation by simply clamping bleeding point for a few minutes. Perhaps its principal usefulness is as a preliminary step in the removal of the upper and lower jaw. It should always be done under the same anæsthesia and not a few days before removal of the jaw. It has been recommended by some. In jaw case though hemorrhage is often very free for a short time no ligation is required even for the temporal or internal maxillary arteries. Ligation takes from the operation of removal of the jaw all its terrors and makes it a procedure practically free from difficulty and danger. In removal of the ganglion in ganglion it has been pronounced by many unnecessary and not helpful and to this I more perfectly disagree. There are two factors in this operation fraught with serious hemorrhage the alar and the middle meningeal artery. Writers speak of the case with which hemorrhage from a torn meningeal can be controlled by ligation or pressure but tying the external carotid has been in my hand easier than tying the meningeal. In his textbook an eminent author advises that if the middle meningeal is accidentally injured and cannot be tied the skull should be cracked and the operation resumed two days later. In a case in which this occurred in my own work after trying in vain to control the artery we tied the external carotid in five minutes the hemorrhage ceased and the operation was completed without further difficulty. Carotid ligation before a ganglion operation disposed effectually of the meningeal as a cause of worry and danger. In removal of fibrous tumors in the back of the throat by throat surgeons in which hemorrhage is such a serious factor I have done the ligation for them and the tumors have been removed without difficulty and with little hemorrhage. In removal of the tongue and floor of the mouth it is exceedingly

useful making the balance of the operation simply one of trimming away the growth. In removal of the lower lip for cancer I have found the operation exceedingly useful and it in no way interferes with primary union afterward. An interesting case in my experience was a young lady who had been bleeding for a week from the extraction of a lower molar tooth until she had become exsanguinated in spite of all efforts by various means to control the hemorrhage. The external carotid was tied in a little more than 10 minutes with immediate control of the hemorrhage and a speedy recovery.

In regard to the technique of this operation one can only follow the description in the text. I look to be convinced that the description are based upon the work upon the dissection table. There seems to be a healthy respect among most surgeons for the carotid triangle but its anatomy is well defined and very fairly constant. The anatomical relations from a surgical standpoint while important are easily handled. The bifurcation of the common carotid in the majority of cases opposite the upper border of the thyroid cartilage and in a series of operations in my hand has never been below that point. In many cases it is much above that landmark even extending up under the angle of the jaw. In one case in which the bifurcation was normal on the right side it was in the edge of the thyroid gland on the left. In two cases no bifurcation was found and in these the common carotid was tied. The relation of the carotid to each other is pretty constant for it should always be remembered that the external carotid is near to the median line in three cases. I have seen the vessel lying upon top of each other and in all of the cases the external is the most superficial. The relation of the internal jugular vein to the carotid is quite variable. In some cases it occludes the vessel in its full retraction during the ligation but in very many cases this relation is not seen. Perhaps the most embarrassing halting place is the combined trunk of the facial and lingual veins crossing at right angles and in many instances forming a very large vessel. The hypoglossal nerve is not in relation at the point where I ligate. Anatomically the external carotid is a superficial vessel and in the neck it actually is so but it is very deep in thick short necks.

I know of no description of this operation that goes much into detail that can help one in guidance. A line incision four inches in length is usually made but an opening of from one to one and a half inches with it enters opposite the

upper border of the thyroid cartilage is usually ample. The incision should go through the skin and platysma muscle. After the deep fascia has been opened I know of no operation in which the finger is more useful. With the index finger the way can be rapidly torn down to the vessel without damaging any of the structures. We are often told that the guide to the vessel is feeling the pulsation with the finger but the rapid breathing of the patient makes this very unreliable. It is a useful thing to remember that the common carotid always has a bulbous swelling just as it bifurcates and this I have found a valuable guide. The vessel is recognized by its yellowish white color. I do not find any distinct sheath at this point though we are told to pick it up and open it. My rule is to pick my way down to the bare artery with a tissue forcep and the point of the finger. Should the trunk of the lingual and facial vein cover the artery extensively it can be pulled out of the way with a hook or can be cut between forceps and it should be tied at once. In a case in which the forceps were left on in the haste due to a sudden hemorrhage at another point the forceps were taken off and when the ligation had been completed and we were looking into a dry wound there was a sudden and horrible gush of blood which at first was inexplicable but it turned out that the compressed end of the vein had opened up.

I take issue with what is usually described as the point of election namely between the facial and lingual branches. The point of election with me is the immediate crotch of the vessel for thus no space is left in which thrombus can form. I have never seen any allusion to the relation of the anatomy or surgery of this vessel to the dense connective tissue the remains of the carotid gland which binds the trunks together. At this point the space between the vessel is simply an indistinct groove. The incision needle is passed from within outward and when it comes against this tissue it appears as if coming directly through the walls of the artery. I rub the point through with the finger or some instrument and thread it and withdraw the ligature with it. This seems to work more satisfactorily than when it is threaded beforehand.

A practical point of extreme value is to have the anesthetist place his finger upon the temporal artery and the operator either cross or pull upon the ligature to see that it stops the circulation in the temporal. I know this is important because once when I did not take this precaution I tied the internal by mistake. Fortunately we were able with sharp pointed scissors to cut the ligature and release it without any damage to the vessel.

The ligation should not be done with a grunt and a jerk because Ballance and Edmonds many years ago demonstrated that a pressure of three pounds was sufficient to close the common carotid. Just enough force should be used to stop the circulation and bring the inner walls of the vessel together. I always employ a double strand Ballance knot with No. 00 or No. 0 forty day chromic catgut. Larger sizes of catgut are entirely unnecessary and I believe sometimes harmful. All clamped vessels are now tied with fine catgut and the skin closed with No. 00 chromic catgut without drainage. In many cases the entire operation can be completed in a few minutes and the ultimate shortening of the entire operation is so great that these few minutes are well spent. Dawson in his prize essay demonstrated that there were 17 different routes by which the anastomotic circulation takes place so that in a few days pulsation returns in the trunk of the temporal artery.

The statement I have made that in the average hands ligation is a simpler procedure than Crile's compression of the common carotid is based upon the fact that ligation controls the same area of arterial distribution and I believe carries less risk than cutting off the circulation from the brain even though this does not last longer than a few hours. An ischaemia of the brain for this length of time may be accompanied. I should believe by some danger of change in the brain cells. In conclusion I wish again to state that I believe that this operation of closing the external carotid carries with it valuable features that have been overlooked and must some day be fully recognized. To those who desire to simplify surgery of the face and head it is a consummation devoutly to be wished.

A NEW STRAIGHT PROSTATIC TRACTOR<sup>1</sup>

By W. O. WILDER, M.D., BALTIMORE  
R. I. C. I. E. dy C. I. I. J. h. H. yk. Hosp. tal

IN reviewing the literature on perineal prostaticotomy especially as pertains to the operative technique it will be noted that one of the main features of the various variations of this operation has always been the securing of as prominent a position of the prostate as possible in the field of operation by means of some form of tractor introduced into the bladder through an incision in the membranous urethra.

Syme suggested the rubber bag Lydton the coat hanger style tractor and de Pezzer and Young have presented very ingenious style of tractor whose blades open after introduction into the bladder.



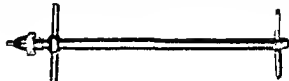
The Young tractor has proved especially popular and efficient on account of its comparative ease of introduction, simple construction, strength and durability.

Still in this clinic for some time past in the routine operation for carcinoma of the prostate with a small rigid vesical orifice a distinct need has been felt for a tractor which might afford a more easy introduction than any of those previously mentioned.

Some years ago Moore of Indianapolis offered to the profession a form of straight tractor whose blades were opened after introduction into the bladder by means of a thumb screw on the handle. Although the idea was an

excellent one its usefulness was rather limited on account of its necessarily large caliber and its weak construction.

Being thoroughly convinced that a straight tractor if one could be constructed of sufficient strength and of a moderate caliber would possess the features demanded in such cases of small rigid vesical orifice the author has designed the tractor herein described. Its practicability and usefulness have already been demonstrated to be of such a degree as to cause its general adoption in all perineal prostaticotomies performed in this clinic during the last year and a half although its value is especially notable in the case of



carcinoma of the prostate where a small rigid orifice is always to be found.

In the accompanying photograph two positions of the blades are shown: one with the blade in direct line with the long axis of the shaft, the closed position of the tractor blade as when introduced through the slit in the membranous urethra into the bladder, and the second position the final position of the blade, at right angles to the shaft. The spreading of the blade is attained after their introduction by rotating the thumb screw on the handle. The tips of the blade tips and the caliber of the shaft render a most easy introduction with small danger of stripping back the mucous membrane of the urethra.

I. m. h. J. m. B. h. B. dy U. l. g. cal. I. J. h. H. yk. H. p. t. I.

## SCALPEL SHARPENING

By G. G. LITTLE, M. T. ROCHESTER, MINNESOTA  
g 11 trum t Sh p M y Cl

It takes time and patience to acquire the ability to sharpen scalpels properly and to give to every knife edge the same keen smooth sharpness. There is quite a trick in getting the right swing to the knife as it is being passed over the sharpening stone. Keenness is acquired by reducing the edge to a thinness limited only by the strength of metal required to keep it from breaking out or nicking too easily. Smoothness is to be had only by the use of the finest abrasive stone known and several important factors should be taken into consideration in selecting the stone for scalpel sharpening.

There are two kinds of abrasive stones that are the most adaptable to scalpel sharpening. They are composed of an even grain or hard crystalline structure that gives the desired cutting edge to the knife blade and retains a smooth true surface much longer than any other stones. Such properties are all very important when the stones are in constant daily use.

The first stone is known as the Pike India oil stone and is used for quickly reducing the cutting edge to the required thinness preparatory to giving it the smooth cutting angle.

The second is known as the hard Arkansas oil stone which is a natural stone quarried near Hot Springs in the Ozark Mountains of Arkansas and is composed of millions of pure silica crystals microscopic in size of the greatest hardness and sharpness. So perfectly crystallized is the stone that it is nearly sixteen times harder to cut than marble, a feature of great importance as it enables the hardest steel tool with fine points or

blades to be sharpened without grooving the stone.

The Pike India oil stone is made of alundum which is a remarkable reproduction of the natural mineral corundum. Alundum is made by fusing bauxite, a soft earth resembling yellow clay and chemically the purest form of aluminum oxide in the intense heat of the electric furnace. The advantage of alundum over every other known abrasive lies in its peculiar combination of hardness, sharpness and temper. By temper is meant strength of grain and ability to wear under pressure. These stones, the Pike India oil stone and the hard Arkansas oil stone are absolutely uniform in hardness and texture, most important qualities.

There is a softer grade of the Arkansas stone that is more suitable for sharpening large knives that do not require the keen sharpness of the scalpel.

A light oil should be used to float the fine particles of steel away from the surface of the stone, thus keeping it cutting freely. We use gasoline.

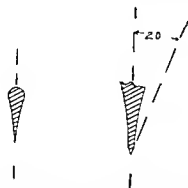
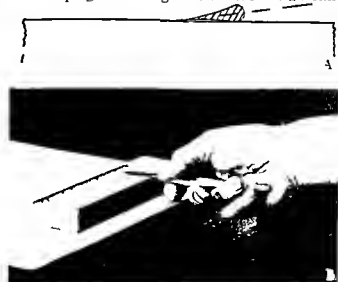
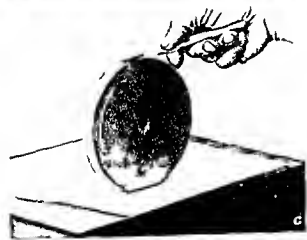
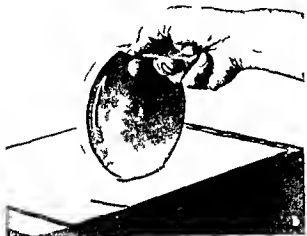
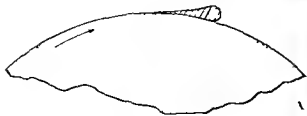


Fig. Cross section of a scalpel blade the angles of which are highlighted. The surfaces come together so that the angle they are parallel and term is in a cutting edge is shown at the right enlarged.



It is the position of the blade relative to the stationary stone when it is ground to the proper thickness. By holding the blade on the surface of the stationary stone in the desired position, the pressure is applied to hold the blade down flat. The just enough pressure to cause the stone to cut most of the thickness of the stone and line the end of the blade. The handle gradually thus causing the curved side to come into contact with the stone and reduce the angle of the point. The movement is repeated in the opposite direction for the other side of the blade.



X



D

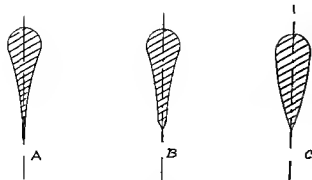
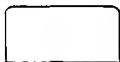


Fig. 5. A, B and C. Three blade sections. A is the outline of a perfectly shaped blade section that can be given a very keen sharp edge. B is an outline of a blade section that has been sharpened without reducing the thickness so that it has become too thick to be made keen though the cutting angle may be the same. C is an outline of a blade section that has been reduced on a flat stationary stone and shows that care is not taken to keep the side straight. Instead they are allowed to become rounded off toward the cutting edge making it hard to sharpen it.



B

Fig. 6. A. Stone being rounded at the corners by rubbing it on a sheet of aluminum foil. B. Shows the corner being filed to a continuous surface for starting the stroke of the blade in the form of a slightly finick which it catches the edge of the blade.

When there is a large number of knives to be kept sharp it is advisable to install a motor driven circular oil stone (Pike India stone of medium

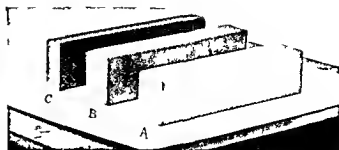


Fig. 8. Three oil stones. A is the hard Arkansas stone, B is the soft Arkansas stone, and C is the Pike India stone. The first two stones are 1 1/2 by 2 by 8 inches and the Pike India is by 8 inch they are all standard sizes and can usually be bought of or through any hardware dealer who handles fine tools or direct from the Pike Mill Co. of Pike, N. H. Many hire



Fig. 9. Calf skin leather (soft fine) is folded once for use to hone the knife. The edge of the knife is carefully touched to the rounded surface with a slight downward motion which will cause it to cut the leather.

grade) for reducing the blades to the required thickness as the work can be accomplished in less time than if the flat stationary stones is used.

The first step in the process of scalpel sharpening is the examination of the cutting edge to determine its thickness and to learn whether the edge is of the required thinness or whether it must be reduced before it is resharpened. Along the cutting edge will be seen a bright polished line on both sides of the blade. These lines are called lands and are caused by the action of the hard Arkansas stone as the blade is being given the final cutting edge. After the blade has been properly reduced to the required thinness it may be resharpened about four times before it is reduced again though it is advisable to give it a few strokes on the Pike India oil stone (the stationary one) and then give it the final cutting edge on the hard Arkansas stone. Note that the edge of the blade is always forward when sharpening so that the wire edge is worked off instead of being put on.

The proper position of the operator while sharpening a scalpel is to the left of the stone so that the elbow is at a level with the surface and on a line with the center (Fig. 4 C).



## PROSTATECTOMY COMBINING THE ADVANTAGES OF THE SUPRAPUBIC AND PERINEAL METHODS USUALLY EMPLOYED

B. A. J. OCHSNER, M.D., H.D., F.A.C.S., C. C. O.  
 Chief of the Urology Department

THE following method of performing prostatectomy has proved so satisfactory in my hands that it seems worth while to suggest that others give the operation a trial. Before adopting this method I made use of the suprapubic method which was popularized by Freyer of London and the perineal method employed with such marked success by Young of Baltimore.

Both methods are satisfactory. The former is simpler and can be executed in less time exposing the patient to a shorter period of anaesthesia. This however is of much less importance since we employ perineal anaesthesia in all cases in which the patient is very old or in which there exist other reasons contraindicating the use of ether anaesthesia. In a large proportion of the cases however the drainage of the bladder is not satisfactory and the period of healing of the suprapubic wound is long and exceedingly disagreeable to the patient.

The perineal operation on the other hand is much more difficult except in the hands of expert with a large experience and even in such hands the average time consumed is about four times as great in this operation as it is when the Freyer method is used.

The drainage is satisfactory and in expert hands the result is about equal.

In these patients who are generally old and not good surgical risks it seems important if possible to combine the good qualities of these two operations in a method which will embody the advantages of both methods and avoid their disadvantages.

The reason that it is possible to execute the Freyer method with such ease and facility lies in the fact that after the bladder has been opened through a suprapubic incision the finger can be carried into the urethra and the mucous membrane cut or torn. The end of the finger then rests between the gland and its capsule and the finger can be swept around the gland so that in a few moments it is entirely free. This is true except that in some instances there are a few adhesions to the urethra but these can be quickly severed with scissors.

Any hæmorrhage can be controlled readily by means of a gauze tampon placed firmly within the capsule. The entire operation is extremely simple and safe and quickly accomplished. Were it not for the troublesome drainage the suprapubic operation would be ideal.

The advantages of the perineal route mentioned above lie in the fact that the hæmorrhage can be easily controlled the gland can be exposed to view and there is ideal downward drainage. However the method is too complicated and tedious to perform in patients in whom the margin of safety is very small at best and it should not be done except by the surgeon who has become expert through much experience.

The following method which I have employed in a large number of cases contains all of the advantages and none of the disadvantages of the two methods just described.

The patient is given a hypodermic of one quarter grain of morphine and one hundredth grain of atropine half an hour before the ether is administered by the drop method. Everything is in readiness so that no time whatever is lost from the beginning of the anaesthesia to the end of the operation.

The lithotomy is irrigated with permanganate of potash solution and a sufficient amount is left in the bladder so that it can be easily introduced but not sufficient to cause a possible rupture. The patient is then placed in the lithotomy position and a grooved sound is introduced into the urethra down to the perineum.

An incision is then made corresponding to the lateral incision formerly practiced in the operation of perineal lithotomy extending from a point half way between the scrotum and anus to a point half way between the left tuber ischi and the anus and extending down into the membranous urethra which is opened at this point sufficiently to admit the point of an old fashioned lithotomy knife. The sound together with the lithotomy knife are passed into the bladder care being taken to carry the sound along the pubic bone in order to prevent the knife from cutting into the rectum thus splitting the membranous and prostatic urethra posteriorly. The knife is

then withdrawn and the operator's finger is carried through the incision along the sound into the bladder.

The finger is now precisely in the same position that it would be if a suprapubic opening had been made and in this fact lies the important advantage of this over other methods of operation because beginning from above and entering the capsule of the prostate gland through the urethra one is in a position to enucleate the prostate precisely as though the bladder were entered from above through the usual suprapubic incision and the prostate gland were to be enucleated according to the Freyer method.

This step of the operation should be carried out with the utmost care in order not to disturb the bladder or urethra unduly. If bands of adhesions are encountered a pair of blunt curved scissors should be carried along the finger and these bands can be cut. Presently the entire gland is free from its attachments to the urethra and the capsule and the gland is withdrawn through the perineal incision by means of Young's forceps. The area is then carefully explored with the finger and occasionally an additional lobule of prostatic tissue is found which has to be enucleated.

The index finger of the left hand is then introduced into the neck of the bladder and the capsule of the prostate is caught by means of fine toothed forceps, one being applied to the right and one to the left and a drainage tube consisting of an inner tube 1 centimeter in diameter and covered in its middle portion by a second rubber drainage tube just large enough to slip over the first one is introduced into the bladder, the inner tube extending into the bladder and the outer tube into the capsule.

Ferguson's retractors are then applied to each side. The capsule is held in position by means of the fine toothed forceps and gauze is packed around the rubber tube into the capsule. The double tube prevents collapse and offers a sufficient amount of resistance to make the tamponing effective for controlling the hemorrhage.

The rubber tube is held in place by means of silkworm gut sutures which pass through the edge of the wound and the outer rubber tube.

Two days after the operation the tube and packing are removed. Occasionally one encounters a prostate gland which is hard and fibrous and cannot be enucleated. In this case it is removed by gnawing away piecemeal under guidance of the finger by means of the Ferguson gnawing forceps.

The entire operation can usually be performed

in less than fifteen minutes. The shock is minimal, the amount of traumatism is not extensive, drainage is downward through the perineum in the most comfortable and most effective position and hemorrhage is controlled by the tampon. The drainage tube and tampon are removed after two days when the patient can sit up. After the fifth day the patient can take daily tub baths and within two weeks the urine usually begins to pass normally.

Older surgeons who have had experience in perineal lithotomy before the time when suprapubic lithotomy usurped this field of surgery will properly remember with what ease and facility stones were removed through a perineal incision representing the first step of the operation just described and how perfectly free from pain and discomfort these patients were after this operation and how quickly and perfectly the healing took place free from complications and with end result which were most satisfactory.

Any surgeon who has previously performed suprapubic prostatectomy will appreciate the fact that the moment he carries his finger up into the bladder through the perineum the removal is quite as simple and easy through this route as the same method of enucleation is carried out and the procedure is really more convenient. This is true especially in fat patients with thick abdominal walls. One must however always carry the finger first up into the bladder and proceed with the enucleation from above downward.

We have here then a method which embraces all of the desirable and none of the undesirable points of the two methods first described.

In case general anesthesia is employed it can be discontinued after the first incision has been made because the operation will be completed before the patient realizes any pain. A very small amount of ether is required for the operation.

In all patients who are not perfectly good risks for ether anesthesia we invariably make use of spinal anesthesia which is borne exceedingly well by these cases. We use one grain of apothesine or novocaine with adrenalin.

It is well to dilate the sphincter ani muscle before beginning the operation in order to increase the comfort of the patient during the few days directly following the operation.

The after treatment consists in the administration of an abundance of distilled water and the giving of light diet.

The tube and the tampon are removed after two days and the patient is permitted to get

out of bed After the fifth day he is given daily hot tub baths also an ounce of mineral oil at bedtime

In case there is a tendency for phosphate to accumulate in the wound the patient is given two or three drops of dilute hydrochloric acid in half a pint of distilled water every hour until the phosphate disappears

The postoperative course of these cases and the results are a successful and satisfactory as they were in the perineal lithotomy

It is wise in every case to stretch the bladder carefully for the possible presence of calculi which may otherwise be readily overlooked

Thousands of old men die annually as a result of complications caused by obstruction due to hypertrophy of the prostate gland and their lives could be prolonged many years Others continue to live in great discomfort who could enjoy a comfortable old age if this form of treatment which can be carried out by any good general surgeon were systematically employed

The complications of prostatic obstruction causing the greatest number of fatalities are pyelitis, uræmia and chronic and acute nephritis and many of the cases suffering from the e-

maladies die annually of pneumonia because with their lowered vitality they are more subject to this infection and less able to withstand it

Of course all preliminary preparation which is indicated for the purpose of getting the patient into condition for any type of prostaticotomy must be employed with equal care in these cases

The use of urotropin dissolved in distilled water for a period before the operation and daily irrigation of the bladder with boric acid or permanganate solution should be practiced in all cases in which the urine contains much pus and in which there is a considerable amount of residual urine

In case in which the passage of a catheter for the purpose of irrigation causes much pain or gives rise to chill or fever temporary suprapubic drainage should be employed for a week or two before making a prostaticotomy

The tube can be accurately fitted and sutured in place so that the urine will be siphoned into a bottle leaving the patient dry and comfortable The tube is left in place for one to two weeks before and after the prostaticotomy The preliminary operation should be done under local or spinal anesthesia

## OPERATING-ROOM TECHNIQUE AND AFTER-CARE OF PATIENTS

B. COLLMAN C. BUFORD M.D. I.A.C.S. (1916)

I AM quite aware of the possibility of expending myself to criticism for consuming your time with the much more important problem of operating room technique and postoperative care of patients I believe you will let me remind you that since the advent of anti-septic surgery the practice of each five year period has been more or less unlike the preceding one that our present views are very different from those we originally held and at all times there has been considerable difference among us as to the method practiced and I believe that you will agree with me that an occasional discussion of this subject is not unfitting It must be borne in mind that our enthusiastic writers and the well established custom of surgical visitation bringing home new ideas are responsible for the introduction of some good and some wholly useless methods into general use For some years past I have been departing from the usual routine and I have been gratified to find that others are doing likewise and that our experiences have been equally

satisfactory in other words there seem to have been an unbroken evolution going on and each man has been able to rectify his experience

In my own work I have made it a rule at the beginning of each winter to make a survey of my operative technique at the Children's Memorial Hospital reviewing it thoroughly and calling the attention of my co-workers in the department to such revision and the reason for them

About two decades ago it was still customary in some clinics to have patients enter the hospital one to three days in advance of abdominal operation for the purpose of retreating the thorough emptying of the gastrointestinal tract and the preparation of the field of operation by a generous

crubbing with soap suds and turpentine followed by the constant application of a wet dressing of some antiseptic More recently Crile has given us the idea of inoculation including in his papers convincing slides showing the cellular change in the central nervous system of animal exposed to fat before death It is just to

assume that similar changes would occur in case of fright. Using these as a basis for the practice many clinicians have adopted the custom especially with patients suffering from exophthalmic goiter of having them enter the hospital some time in advance of the operation to accustom them to their environment and free them from operative and anesthesia fear. Daily inhalations of an anesthetic were given with the pretense to the patient that it was a part of the treatment. On a day not made known to the patient complete anesthesia was induced and the radical operation performed. Previous to Crile's publications I had adopted the opposite practice with exactly the same object in view. My interval work is done on set days beginning at two o'clock in the afternoon. I ask the patients to enter the hospital before ten o'clock in the morning of the day of the operation. This of course does not apply to patients who are very seriously ill or upon whom a diagnosis is to be worked out after they reach the hospital or upon whom the gastro intestinal tract is to be opened or to those for whom it is more convenient to enter the hospital earlier. It especially applies to those having chronic lesions of the breast neck and axilla chronic gall tract lesions chronic appendicitis hernia chronic affections of the pelvic genitalia and practically all goiters. The relative value of this plan can best be estimated by reference to my goiter work alone. It is about eleven years since I did my first goiter work. There have been no deaths and no serious complications among the reasonable risks. Five of these showed very serious cardiovascular and mental damage and of this group two could hardly be classed as conscious of what we were about to do for them therefore the element of fright was almost eliminated. They represent the only two deaths I have had. My experience has been sufficiently voluminous and so satisfactory as to cause me to feel that to obtain the best results it is not needful to hospitalize patients before operations in conformity with the theory of dissociation. I do not attempt to mislead patients concerning the seriousness of operations at the same time I attempt to give them whatever just assurance and confidence I can and urge them to enjoy themselves as freely as possible in the interval but without dissipation. I believe that the night previous to the operation pent away from the hospital is apt to be more restful. Full meals including breakfast on the morning of the operation are encouraged except where the stomach or intestines are to be opened. No catharsis whatever is indulged in. The patient is requested to

go to bed at once upon reaching the hospital and if possible to go to sleep. An enema is given an hour or more before going to the operating room. One eighth to one quarter of a grain of morphine and one one hundred and fiftieth of atropin are given hypodermically three quarters of an hour before the operation.

The field of operation is prepared before the patient comes to the operating room either in his room or in the preparation room the object being to allow the anesthetic to be proceeded with as soon as the patient is properly placed upon the table and thus diminish operating room fright. We also thus avoid a considerable source of danger through the scattering of soap bubbles and drops of water in the operating room avoid confusion and shorten the period of anesthesia. If one times the preparation by the watch after the patient is asleep he will usually find that the patient has been unnecessarily narcotized for more than a quarter of an hour. I think that careful observation will show that there are a good many flaws in the technique of the preparation of the field of operation when it is done by transitory help unless it is supervised throughout by a stationary experienced and reliable person. In most cases the fields prepared are too small and the coverings become dislodged because of the insecurity of bandages and much time is lost in re preparing on this account. In radical operations on the neck we commonly find the occipital region unshaved and the upper part of the chest unscrubbed and unprotected in appendices hernias and suprapubic incisions only the suprapubic hair has been removed and there has been inadequate preparation of the external genitalia and the upper part of the thighs. I believe that the matter is important enough to justify all of the preparation work in large hospitals coming under the direct supervision of one stationary and experienced person.

When Lawson Tait told us that the careful removal of fat and epithelium by the liberal use of soap and water was an adequate surgical preparation those of the opposite school who were using soap poultices soap water bichloride and alcohol preparations followed by wet dressings of bichloride of mercury looked upon him as a heretic. I think we are coming nearer his view than that of the opposite school. I would be quite content with a liberal gauze sponging of the field with benzine followed by alcohol and drying but have had to abandon this method on account of the frequency with which transitory help allowed benzine to gravitate to other parts of the body where it was not noticed and resulted

in severe blisters.<sup>1</sup> I have used soap water and alcohol preparation long enough to believe firmly in its adequacy but allow the use of any other antiseptic solution which conforms with the hospital routine because I consider it unimportant.

I believe that all blankets should be left outside of the operating room as they are rarely carefully handled and are certainly sources of danger because of the dust and lint shaken off them. I believe that special covering should be provided in the operating room enveloped in muslin slip and that in abdominal operations they should be in sections so that a warm light narrow cover could be placed over the chest and another below the field of operation thus avoiding unnecessary weight heat and the piling up of a thick dirty article close to the field of operation.

When the patient is sufficiently narcotized and the dressing removed the field is quickly poned with alcohol on gauze and dried. While there may be some use for iodine in accident and military surgery I believe that it is harmful misleading and unnecessary in ordinary surgical practice. If one paints his own skin with a thick coating of iodine and then cover it with a thick dressing he will soon obtain some ideas as to what it may do to burned tissues. It is an irritant to the least. In abdominal work I consider it especially harmful because if it is allowed to get upon the peritoneum it must cause serious chemical irritation and damage and exfoliation of endothelium which we are striving to keep intact. Results without it in my hands are sufficiently satisfactory to cause me still to refrain from using it.

After drying the field is surrounded by linen. It is right here that I feel that considerable leakage occurs in our cases. I notice the return of the use of sheets below and above the field of operation which are tucked around the field and in the direction of the anæsthetist. It is during this tucking that the hands frequently become contaminated of course without being noticed by the one at fault. The sheets are often piled high and lie wrinkled and insecure when first applied. After a little shifting, one is not quite sure just what area has touched the skin or clothing of the patient. It seems much more simple for us to go back to the draping of the field with towel which are covered only by one

laparotomy sheet with an opening in it which may be enlarged by unbuttoning or made smaller by the use of added towels. The skin clips an invention of recent years should always be used to prevent slipping of the linen especially on the small bodies of children. Towel fixed to the edge of the incision by skin clips and turned back to that side covering the clip are very good additions to anyone's technique and eliminate contact of the hand or instruments with the skin of the field of operation.

The sterilizing of instruments by boiling is uniform among us and need not be commented upon except to say that needles knives and scissors should always be boiled. It has been demonstrated conclusively that the subjection of the steel to 95 per cent carbolic acid does not insure sterilization. Needles need not be lost in the sterilizer if fixed in gauze or put in a perforated needle box and these can certainly no longer be any excuse for not boiling knives since partitioned boxes which protect them from being nicked are now available. I consider it better to run a knife with each operation than to risk chemical sterilization. We are also told that knives are not boiled because their temper is ruined. Is it not a fact that the temper of steel is not ruined unless exposed to a red heat?

Long ago I adopted dry technique. At the Children Memorial Hospital no water is allowed on the nurse table. Blood is removed from the instrument with dry sponges.

In the use of laparotomy sponges we are confronted by two choices. One teaches that dry sponges remove more peritoneal endothelium and cause more trauma. The other tells us that wet sponges pass through one more barrier and one more pair of hands that the water may have been contaminated and the wet hands may be covered by punctured gloves through which infected perspiration may reach the sponge when it is wrung dry. I have for many years used dry sponges believing that the less they are exposed to handling the safer they are. It is far better to avoid the use of laparotomy sponges when possible. I think I am able to do this in more than half of my abdominal work.

In cases of diffused septic peritonitis I consider it rarely advisable to fluff the abdomen believing that drainage is facilitated by the inclined position of the body is sufficient. It has always seemed to me that by irrigation we remove the solid covering of the endothelium which is there for protective purpose and many times it seems to me that the endothelial covering immediately became clouded. It is argued that this is just

Wb bby dt f i n h k fth l k d f  
 c en ly oc Th d m l m l by f h l  
 At b d fth meet c f h Ch l l h h l  
 p b y vol f h y d l j p ool l d g h d  
 p p rubb l

fied in the severe cases a view which I do not agree with because it prolongs the anesthesia greatly increases the trauma and shock as the hand passes among the intestinal loops and does not conform with the idea of get in and get out which seems to have given us altogether the best recovery rates I believe that the leaving of salt solution ether and other chemicals in the abdomen is harmful and unnecessary.

My tendency is to drain abdomens less liberally and less often than in the past but I notice a tendency of some to return to the practice Robert Morris taught about 14 years ago of closing the abdomen after the removal of appendices in a state of advanced pathology I think I recall a correction of this view published by him I also recall that my unexpected appendiceal losses have been mostly in those I failed to drain They were not all dead or ruptured appendices but some showed advanced damage and definite exudate about the appendix which all surgeons had previously drained In cases of oozing of consequence following extensive abrasions in the abdomen I now always drain When I failed to do so I found retentions occurring too often

I close abdomens by layer sutures using No 1 chromic gut but to save time loop the thread to fix it as each layer is closed and proceed without cutting the thread to the next layer I use a running suture of iodine gut to close the subcutaneous fat where its thickness justifies closure Fine iodine gut is used because it approximates the surfaces sufficiently to prevent the leakage of fat from the cut surfaces effaces dead spaces into which the fat and serum may leak and it does not linger so long in the tissues causing prolonged and marked reaction during absorption and consequent later centralization of infection There is also some foundation for the belief that the approximation of the subcutaneous fat by suture tends to diminish keloids Wherever special neatness is desired I close the skin with subcuticular sutures of silk worm gut

More than 15 years ago I abandoned thick dressings for clean wounds instead covering them with about four layers of gauze the length of the wound and  $1\frac{1}{2}$  inches wide over which the ends of the silk worm gut suture are tied I place a long wide strip of adhesive across this in abdominal wounds going obliquely about four fifths around the body following the body contour In hernias and appendices the strip begins behind the trochanter and ends behind the lower ribs of the opposite side In more serious and lengthy abdominal operations where I expect severe vomiting a wide strip of adhesive is run in the

opposite direction the two crossing as an x at or below the middle of the abdomen This gives considerable support to the abdomen and if vomiting occurs makes it less distressing Face wounds and all harelips are left without dressings In some quarters very good surgeons are not dressing clean abdominal wounds at all

Just a word about hand sterilization I scrub under running water After the soap is removed I use a 1 per cent solution of lysol followed by alcohol both being poured from a bottle by a nurse I direct that these be poured slowly in the smallest possible stream over the center of a basin I believe that this is the neatest and most economic way to use hand solutions No liberal dashes are allowed I use lysol or any antiseptic other than alcohol to conform with the present day teachings to internes and nurses I have used soap water and alcohol alone often enough and long enough in hand preparations to cause me to believe that it is sufficient For many years wash basins have been eliminated from the operating room during my work at the Children's Hospital They serve as catch basins for dust lint and bubbles from the respiratory tract It is an unclean habit and unsafe for more than one pair of hands to wash in the same water Rubber gloves are routinely used both in pus and clean cases but I find that it is constantly necessary to remind assistants and nurses to put them on without allowing skin contact with the outer side of the gloves I have abandoned the use of rubber arm coverings but still use long sleeved gowns smoothly tucked within the cuff of the glove If arm coverings are not used bare arms are sure to come in contact with clean linen instruments and tissues and in long operations there is danger of drops of sweat leaking out of the glove

Immediately after the publication of Mikulicz's paper on the use of white cotton gloves in surgery I purchased for the Fenger Clinic white cotton silk and rubber gloves of different types studied their relative value methods of sterilization and care and their bacteriology and reported on these at the Chicago Medical Society about twenty one years ago I well remember how surgeons expressed doubt as to the possibility of their usefulness If I were in charge of a large teaching clinic I believe I would return to the use of white cotton gloves in all clean work on account of economy the encouragement of dry operating and neatness particularly on the part of assistants In the Fenger Clinic Dr Waters and myself were able to show only slight staining on our gloves after assisting in many major operations

We commonly see at the end of many major operations hypodermoclysis begun. This has undoubtedly caused endless unnecessary pain and relatively rare benefit. I believe that there is seldom any use for it. The fluid which it is intended to supply may best be given by mouth or rectum. I resort to proctoclysis very much less frequently than in former years, using it with a view of diminishing thirst in selected cases only and in the hope of having larger quantities retained in very septic cases. I believe this to be a therapeutic measure which has been much abused in surgery. It has caused endless discomfort through unnecessary application, much unnecessary labor for nurses, and I believe the amount which is usually taken up is overestimated.

The transfusion of salt solution has also been abused, and I am told by one of the most experienced surgeons in the past war that it is looked upon by many at the front as harmful. Several years ago in a paper on "Surgery of Infancy and Childhood" I called attention to its harmful effect on children when used in cases of congenital or acquired hæmophilia where it produces by dræmia and further diminished coagulability. It is being rapidly supplanted by direct and indirect transfusion of blood which is subject to still further simplification. Among the more simple devices are those of Bernstein of Johns Hopkins and Abelman of this city. My attention has recently been called to the intravenous use of solutions of gum arabic in war work for the purpose of increasing viscosity, coagulability and filling vessels.

Long before the publication of Fowler's paper I had used and I think others in Chicago were using the postoperative sitting position in certain septic abdominal conditions. I found that unless I strictly supervised it myself and used twisted sheets between the thighs tied to each post at the head of the bed, the patient routinely slipped down, the abdomen remaining flat upon the bed and the thorax slightly elevated in a cramped and uncomfortable position. I then began and still use in cases of septic peritonitis a high elevation of the head of the bed, occasionally adding a back rest increasing the elevation only fifteen to twenty five degrees. This secures the most certain and permanent position to promote drainage by gravity, and I think is less likely to invite thrombosis in the lower extremities because we avoid acute flexion of the thighs.

When the patients are fully awake I order as a routine an ounce of water per hour for three hours, after which two ounces per hour for three

hours, then 3 ounces per hour if wanted is given until I next see the patient. Of course the patient is not awakened for this. If vomiting persists I am inclined to encourage it by increasing the amount of water at any time to promote emptying of the stomach.

I am certain that the time consumed in operations by all of us is shorter than in former time that the patients are far less either soaked and less traumatized and therefore there is less vomiting. In my last five appendectomies there was moderate vomiting in only one as I recall it. This patient was the only one who neared the average discomfort from gas pains. None of them had distended abdomens. I have looked upon the usual postoperative vomitings as being largely due to acute gastritis, remembering that the gastric juice is laden with ether which is in a large part eliminated by the gastric mucosa and usually treat it as such, often resorting to the use of gastric lavage. I have also assumed that not only were the secretions of the gastro-intestinal tract perverted on account of the irritating effect of ether, but also on account of the shock due to handling the viscera. When one understands the acute digestive disturbances that immediately follow upon taking food after shock and fright, it seems quite reasonable that after operation before the gastro-intestinal tract is emptied of perverted secretions laden with ether, food will not be well taken care of. It is for this reason that all of us have refrained from early feeding. While awaiting the first feeding, I see that the patient has an abundance of water to dilute and facilitate the removal of the gastro-intestinal contents. If there is gaseous disturbance or even moderate discomfort in the abdomen, enemas of plain water are given in immediate succession until there is a good result. I rarely give cathartics during the first five days following abdominal section as I believe they are commonly the starting points of our serious gaseous disturbances. There is seldom any need for the relief of abdominal pains following laparotomies by use of morphine. In case of severe pain its use is exceptional. Evacuation of the lower intestinal contents by diligent use of enemata will often be all that is required.

All of us are acquainted with the evidences of temporary interference with nutrition in children following acute infectious diseases and even temporary digestive disturbances as shown very clearly by the transverse linear depressions in the teeth which appear later and also with the effect that it has upon adults who undergo considerable physical exercise before breakfast. We know that an actual

weakened condition exists following operations which is out of proportion to what might have been expected and which lasts for a considerable time. I believe this is partly due to suspended nutrition and I have attempted to combat it by full feeding up to and including breakfast on the day of the operation and by giving very small quantities of concentrated food early starting between twelve and twenty four hours after the operation. I have used for first meals with satisfaction the half of an egg white boiled also the half of one boiled egg with a cup of very weak tea or hot water tea either containing a small amount of sugar. If there is no disturbance this meal is repeated once or twice. Later on a very small piece of toast is added and then the regulation gruel and soft diet is resorted to. I believe that I get less fermentation from this feeding than from any other. Food is given at meal time only. At no time during convalescence are egg nogs or other sick room drinks permitted at meal times or between meals.

I do not often allow patients who have had abdominal sections to sit up in bed at any time during convalescence believing that acute flexion of the thighs promotes thrombosis. One to three days in advance of the time that the patients are to get up they are allowed to sit on the side of the bed with the legs hanging over for one to five minutes every three hours and they are soon asked to assist themselves in doing this. They are then asked to stand for the same length of time at like intervals and on the same day or soon following are allowed to sit in a chair for 15 to 30 minute periods several times a day. I believe that this makes it possible to get patients out and around earlier than by any other practice.

As I have eliminated the hospitalizing of patients before operations and have simplified their preparation and ceased to use meddlesome postoperative therapy I have observed that with each step there has been greater certainty of a smooth convalescence and little or no vomiting and very moderate abdominal pain in my abdominal sections.

At this time members of every vocation are expected to take stock and start anew. So long as the major portion of surgical work is really done by a large group of men who have not sufficient volume of it to justify their own group of helpers would it not be a great step forward if in all large hospitals the preparation of patients, the anæsthesia, table nursing and first assisting were all done by stationary trained help and that

internes be generally given stationary services?

The internes and pupil table nurses are always enthusiastic and anxious to render efficient assistance but are in truth but little help until near the end of their service. Our histories are sadly neglected and often entirely unreliable when written by the untrained men and the operative and postoperative histories are rarely accurately written unless we dictate them ourselves. If they are to serve as records for any reason they must be accurately written. None of us doubts the good intention of both the new interne and pupil nurse but he are not often ready for the task they assume.

The question of pupil nurses serving at the instrument table as first nurse is altogether the most important one in the operating room technique that confronts us today. It is a heritage of the early days of training school work when considerable operating was done in homes both in the city and in the country. The demand for such a service at the present time is almost negligible. I believe that more than 99 per cent of the calls for graduate nurses today in hospitals and private practice do not require any particular surgical skill which must have been acquired as first nurse at the operating table. One always has a great deal of difficulty in getting the board of managers of a training school to accept this modern point of view but it has been my observation that wherever hospitals have adopted the plan of having stationary nurses serve at the operating table they would feel that they were taking a step backward if they abandoned this plan. Nurses in training may get all of the knowledge they require by acting as secondary nurses in the operating room which gives them training in the preparation of supplies and detail work. They may be allowed to scrub and serve in minor operations and in certain major operations where two scrub bed nurses are needed. I do not believe that a plan which is so harmful to the interest of patients and so wearing on surgeons should be continued.

Men seeking internships are very apt to accept those offering rotating services and many hospitals have held to this plan because they believed it to be easier for them to secure the best type of internes. While this plan has a certain advantage in giving men a variety of work I do not feel that the length of service in any department is sufficient to impress them with its importance to properly educate them or to infuse a proper spirit of enthusiasm.



## THE USE OF AUTOMOBILE INNER TUBES TO PROVIDE LUNG EXERCISES AND TO MAKE ESMARCH BANDAGES AND TOURNIQUETS

By CARROLL SMITH M.D. F.A.C.S. St. Louis, Missouri

ONE of the frequent causes of delayed healing of empyema cases is the failure to have the patient carry out suitable lung exercises. The reason for this neglect seems to be due to the fact that the method of blowing water from one bottle to another and other similar procedures have not proved satisfactory. For some time I have been instructing my empyema patients to blow up an old inner tube from which the valve has been removed. This exercise should be done several times daily after the acute symptoms have passed. I have found that this method gives better results than any other mechanical procedure and I am sure it has hastened the cure in numerous cases which have been under my care.

The usual commercial Esmarch bandages and

tourniquets deteriorate rapidly. In using Bier's intra-arterial local anesthesia I have found great difficulty in keeping satisfactory rubber bandages. The idea occurred to me that excellent bandages and tourniquets could be made from discarded automobile inner tubes. Bandages two or three inches wide may be cut from the tread surface or the valve stem side of the tube. Such bandages are elastic strong and above all durable. The rubber stands boiling well. One bandage which I have used for more than two years still retains its strength and elasticity. Narrow strips of the same material make excellent Esmarch tourniquets.

These two measures not only serve admirably but in addition the material is easily procurable since discarded automobile inner tubes may be purchased for a nominal sum.

## ADRENALIN

AN ADJUNCT TO AND AN ANTIDOTE FOR APOTHEGINE

By HERBERT C. HAMILTON D. TROIT, MICHIGAN

ALMOST every medicinal substance is a potential poison and should be considered from this viewpoint. When for any reason toxic symptoms follow its administration the physiological effects of a toxic dose should be known and information available as to a counteracting substance.

Under certain conditions local anesthetics may produce secondary effects of an entirely different nature from their beneficial anesthetic properties. In the case of cocaine the high degree of toxicity and its habit forming effects are such as to limit or inhibit its use in many cases.

Among the substitutes for cocaine using the term in the sense of an equivalent rather than an inferior substance, novocaine for some years became very popular. Braun (1) states: Experience and experiment have shown that by doubling the dose of novocaine so as to make it as effective as cocaine and at the same time by adding suprarenin (adrenalin) novocaine has become the ideal anesthetic for injecting into the tissues and has made the use of cocaine unnecessary.

Attempts have been made in some cases to overcome certain of the objectionable features of cocaine by a combination of chemicals which will enhance its value either directly or by applying the cocaine in its basic form (2) or indirectly by localizing its action and so making a smaller dose more effective. Braun (3) says: It was observed that the local anesthetic power of cocaine was enormously increased by the addition of very small quantities of suprarenin.

Apothegmine is a local anesthetic which is materially less toxic than cocaine and is entirely free from habit forming effects. By laboratory tests approximating two of its method of application—on the sciatic nerve of the frog and intracutaneously applied to human subjects—it is demonstrated to be equal to cocaine in its action on mucous membrane while less effective than cocaine. It is identical in dose and kind with that of novocaine (4). Its toxic action is also identical with that of novocaine shown a strongly depressing effect on the heart and respiration.

While local anesthetics are ordinarily used

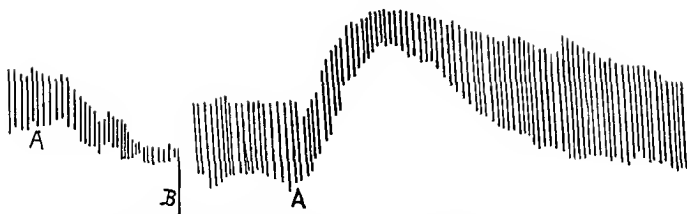


Fig 1

Fig 2

Fig 1 A Injection of fatal intravenous dose of apothesine B Death of dog

Fig 2 Injection of 0.0001 grams adrenalin as solution of adrenalin chloride at A

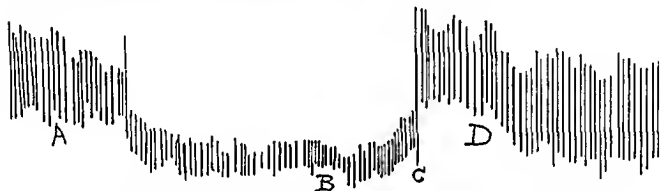


Fig 3 A Injection of 0.08 grams apothesine intravenously B Injection of 0.0001 grams adrenalin C After complete recovery injection of 0.08 grams apothesine and 0.0001 grams adrenalin

in doses minute compared to the amount necessary to produce a systemic reaction there are occasions on which such reactions are evident either because of an excessive dose or because of hypersensitiveness to its toxic action. In such cases knowledge of an antidote or counteracting substance is of primary importance and should be in the hands of every user of the anæsthetic.

The minimum fatal subcutaneous dose of apothesine based on guinea pig experimentation is several times that for cocaine that is it is much less toxic. The fatal dose calculated to the average weight of a man is more than a half ounce of the pure crystals.

The toxic effects are exerted largely on the circulatory system. Blood pressure and heart amplitude are greatly reduced under its influence in animal experiments and death is apparently due to the depression of the heart.

What is therefore more natural than to turn to adrenalin the characteristic effects of which on the circulatory system are exactly the opposite of those of apothesine and which when properly administered acts even more quickly. Experiments on anesthetized dogs confirmed

this theoretical counteracting effect and proved as shown by the illustrations that an otherwise fatal dose could be favorably influenced by administering adrenalin chloride solution and that when the latter was injected with the apothesine intravenously its depressing action on the heart could be eliminated entirely.

Although in rare cases only is apothesine injected intravenously its effect from this form of administration is much more rapid and is identical in kind with that from the subcutaneous injection and is produced by a much smaller dose. The results therefore are comparable although the doses are not.

The experiments were carried out on anesthetized dogs the apothesine being administered intravenously on account of the promptness of its action when so given. The effect on the heart when so administered is so rapid that it was found necessary to mix the two substances since the one acts almost as promptly as the other. When the two agents are injected at the same time the depressing effect of a large dose of apothesine is not evident until the action of the adrenalin has ceased to be a factor in sustaining the am-

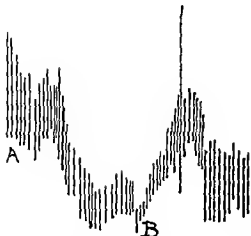


FIG. 4. A. Injection of 0.32 gram per theine and 0.0005 gram adrenalin. B. Injection of 0.0005 gram adrenalin.

plitude of the heart beats and the blood pressure. When this occurs due to an insufficient dose of adrenalin a second small dose will restore the circulation to its former condition and sustain blood pressure until the toxic effects of the apothesine are gone and the dog will remain in good condition.

The tracings shown are those typical of apothesine of adrenalin and of the resulting effects from judicious mixtures of the two. The dose of adrenalin which raises the blood pressure of a dog is 0.00005 gram or 1 mil of adrenalin chloride 1:100,000 a dose varying not so much with the weight of the dog as with the condition of the

circulatory system. A dose ten times as great has a much more pronounced effect but not serious. From a mixture of the two intravenously administered and with a subsequent dose of adrenalin if necessary blood pressure and heart action can be so controlled that no serious results follow the administration of a dose of apothesine which without the adrenalin would have been fatal within a short time.

The simultaneous administration of adrenalin with apothesine as with cocaine and novocaine is not for any purpose other than to localize and intensify the anesthetic action since its stimulating action on the heart and vessels obtained only by intravenous injection. But the antidotal effect is indirectly effective even from the subcutaneous administration because adrenalin prevents general absorption of the anesthetic and by intensifying the action of the apothesine makes large doses unnecessary.

The value of adrenalin therefore for both purposes to limit absorption and to sustain the heart is due to its characteristic properties of contracting the blood vessel and acting as a prompt and powerful cardiac tonic.

NOTE.—At the request of the publisher the graphic was replaced by a better one.

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# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING FEBRUARY 6 1919 DR THOMAS J SULLIVAN PRESIDING

### DUODENECTOMY AN ORIGINAL TECHNIQUE

DR JAMES J MOORHEAD (by invitation) Below is an abstract of the paper read by Dr Moorhead regarding his technique in duodenectomy

Is the duodenum one of the so called vital organs and if so what is the nature of its vital function?

The author presented a preliminary report of work done on this problem describing a method by which the canine duodenum may be completely extirpated The operation is done in three stages

1 The abdomen is opened through an incision 10 centimeters in length starting midway between the ensiform cartilage and the right costal margin the rectus muscle is displaced outward the left index finger locates the hepatopyloric ligament which is cut and the finger is passed downward behind the pylorus the greater omentum is drawn to the left and an opening made through an avascular space in the dorsal mesentery close to the edge of the pancreas rubber covered clamps are applied on either side of the pylorus and four ligatures tied (two above and two below) the pylorus is divided on a Kocher director The gastric end covered with a warm pad is laid aside The mucosa of the duodenal end is dissected from the muscularis for a distance of about 3 centimeters and this isolated portion removed The serosa and muscularis are infolded so that a portion of the pancreas covers the blind end The transverse colon is located and drawn outward carrying with it the first loop of the jejunum This is brought up in front of the colon and anastomosed to the open pyloric end of the stomach the proximal part of the bowel at the lesser curvature The abdomen is closed A subcuticular stitch apposes the skin No dressing is employed Buttonhole silk is used exclusively in our work

2 Two weeks later an incision similar to that described above opens the peritoneal cavity The duodenum is picked up the common bile duct identified and excised from the duodenal wall The mucosa of the excised portion is completely removed The opening made is closed by Lembert sutures Wirsung's duct which is the accessory duct in the dog is ligated and divided The gastrojejunostomy is located and a small opening made in the jejunum about 3 centimeters distal to the junction The common bile duct with its attached

duodenal wall held by a thread armed with two needles is drawn through an opening in the dorsal mesentery under the duodenum These two needles are introduced into the jejunal opening and emerge about  $\frac{1}{2}$  centimeters distally Sufficient traction is applied to draw the duct through the orifice and the threads are tied on the serosa One Lembert suture is used to effect closure around the duct

The duct of Santorini is now found Its usual location in the dog is at a point about 3 centimeters proximal to the place where the pancreas turns away from the duodenum This duct is transplanted by the same technique as is the common bile duct about 5 centimeters distal to the implantation of the common duct The omentum is carefully arranged and the abdomen closed

3 Following an interval of 14 days the abdomen is opened for the third time through the right rectus abdominis Multiple adhesions are commonly found The blind duodenal end is sought and liberated sufficiently to allow its being brought to an accessible position The bowel is opened longitudinally along the surface opposite the pancreas for a distance of 8 centimeters Hysterectomy clamps are applied parallel to and about 2 centimeters from the cut edge With a sharp uterine curette the mucosa is completely removed The wall is now divided immediately below the clamps and the remaining edges infolded with a continuous stitch Proceeding distally this technique is repeated until a point 4 cm below the duct bearing portion of the duodenum is reached Beyond this point a typical resection completes the duodenectomy

*Advantages of this method* The gastrojejunostomy is made at the true physiological location the pylorus This region is undisturbed in the subsequent steps The biliary and pancreatic secretions are preserved The jejunum is made to serve as a substitute for the duodenum in receiving the digestive juices So far as can be ascertained the common bile duct and the major pancreatic duct have not heretofore been successfully transplanted into the jejunum at one time Cholecystenterostomy in the dog is frequently fatal Cholecyst gastrostomy disregards well established principles of digestion

Dogs so operated upon will live in normal state of health The duodenum is therefore not essential to life

## DISCUSSION

DR LOUIS D. MOORHEAD In view of the question of the duodenum from a physiological standpoint two considerations present themselves. First we may look upon the duodenum as a portion of the small intestine into which certain secretions are discharged and through which food passes during one of the stages of external metabolism. Second we may look upon it as one of the so-called vital organs possessing, either a detoxication function or else adding some internal secretion to the blood.

If we take up the first consideration we find that the external secretions have been preserved even after duodenectomy and that the only change that has occurred is that a small part of a passage way has been lost. However if we give our attention to the second point we may determine first whether the duodenum is one of the so-called vital organs and second if so what this vital function may be.

What is meant by a vital organ is a moot question among physiologists. Some consider a vital organ one without which life cannot exist. Others consider a vital organ one without the functioning of which certain changes, irremediable and characteristic occur in the organism. As an example of the former we have the parathyroids. It is known that if the parathyroids are removed the animal soon shows characteristic changes which are irremediable and in a short time the animal dies. As an example of the latter we have the thyroid gland. If the thyroid gland is removed completely it is not incompatible with life. However certain changes characteristic and irremediable occur in the organism. We see the development of myxedema, etc.

The duodenum is not a vital organ in the first sense for life persists some time after its removal. For years the removal of the duodenum was considered incompatible with life and Matthews in 1912 confirmed this statement but we now see that such conclusions resulted from imperfections in surgical technique. In the second interpretation as to what constitutes a vital organ we cannot yet answer the question for the number of experiments is not sufficiently large nor has enough time elapsed to permit conclusions. But we can say that the duodenum is apparently not an essential organ since no changes in the organism have as yet been noted after its removal.

DR CARL BECK Duodenectomy is a new operation and Dr Moorhead has worked out a method which can be repeated after a number of experiments with the greatest safety. As to its value Dr Moorhead has pointed out the physiologic importance. We know that a large number of operations of this kind have been done by Pawlow in the Physiologic Institute which have led to many physiological facts that are valuable and so it may be equally valuable to find out some facts from observing these animals in the course of weeks and months determining whether the changes

which take place are transitory or permanent. About this we can only philosophize or make hypothetical observations.

As to the practical value of duodenectomy I do not know of any pathological conditions of the duodenum of sufficient importance to warrant such radical removal. Carcinoma of the duodenum would perhaps be the only pathological condition which would call for duodenectomy and such a condition is practically unknown in that organ. I do not recall ever having seen a carcinoma of the duodenum and from my knowledge of the literature of the subject there are very few such cases reported. Of course there are cases of tumor involving the duodenum but these tumors are adenomatous in character and we are able to resect the tumor from the duodenum without much difficulty.

One interesting technical point mentioned by the essayist is the transferring of the duct and the method described of doing it is interesting. Years ago I tried a similar method with the ureter. Healing occurred very nicely without much discharge either from the ureter or the duct. The urine passed through without leakage. The serosa forms cicatricial tissue and makes a solid union. The constriction afterward is characteristic. In the ureter it leads to rapid disintegration of the kidney. The insertion of the ureter into the bowel is possible but it leads to stricture at the opening and the stricture gradually leads to destruction of the kidney. This might be the case with the operation described after a time there is apt to be constriction of the duct which leads to stricture and naturally to ascending infection in the liver going up toward the gall bladder in most cases.

DR MOORHEAD (closing) Based on a considerable experience I do not anticipate closure of these transplanted ducts as stated by Dr Beck. This does not happen if one transplants the entire duct including the papilla.

## IRRITATION OF THE DURA OR INNER PERIOSTEUM OF THE SKULL

DR CASSIUS C. ROGERS discussed the question of irritation of the dura and presented case (See p. 52).

## DISCUSSION

DR EMIL G. BECK I was pleased to hear Dr Rogers repeat three times in his paper that the plates he exhibited were taken stereoscopically and I agree with him fully that a single plate of the head is useless. Unfortunately in almost every meeting, here X-ray plates are shown on the plates are exhibited from which one cannot draw reliable deductions. For fracture of the skull plate may be good enough but not for chest or head work. I have been pounding away on this subject for fifteen years in trying to impress upon members of the profession the importance of having stereo-

scopic roentgenograms. If more physicians would take the trouble of having their roentgenograms made stereoscopically they would find it of enormous advantage in the treatment. In fractures and in pathologic conditions of the bones the finer points in the differential diagnosis can be cleared up only by stereoscopic pictures. This is particularly true in differentiating osteomyelitis, tuberculosis, syphilis, gonorrheal arthritis with destruction of the joints, etc. Even the expert is unable to make a diagnosis from a single picture in these cases unless the lesions are far progressed. When you compare the final changes in the bone seen by means of the stereoscope you will note the facility in making a diagnosis. I cannot too strongly endorse the use of stereoscopic pictures in all pathologic conditions.

DR CARL B. DAVIS. I would like to ask Dr. Rogers if this woman from Detroit had spinal puncture and Wassermann tests made of the blood?

DR ROBERT H. GOOD. In the last case reported by Dr. Rogers the patient if I remember rightly had several pieces of the skull removed and still had symptoms of extradural irritation. I have always thought that extradural irritation meant there was increased pressure in the skull, but with these pieces of skull removed it seems to me the pressure could not be marked so that this case proves that we have these extradural symptoms without any special increase of pressure in the skull.

In the second case Dr. Rogers made the statement that the temperature was normal. This was the mastoid case. I take it for granted that probably the temperature was taken only once at the hospital before operation. If the patient had been in the hospital for a day and the temperature had been taken every three or four hours I think the temperature would have been found subnormal without a question.

My experience in these cases as far as irritations from lime deposits are concerned has been limited but of irritations from frontal sinusitis and mastoiditis I have had twelve or fourteen cases and the ease with which this disease is diagnosed is surprising. It is simple to make the diagnosis of extradural irritation. As to pain in a case of mastoiditis sometimes the patient has none. Sometimes the pain is ordinary. If you make pressure on the mastoid the pain is increased but when we have extradural irritation we have a different proposition. Pain is intense. The patient complains of a constant pain usually sometimes interrupted and this pain is greatly increased if you make external pressure over the skull. In some cases of mastoiditis the temperature will vary from 99 to 103.4 and as soon as we have extradural irritation the picture changes entirely. We have a subnormal temperature of 96, 96.1, and 97. The pulse becomes very slow as low as 55 and 60 when we have extradural irritation. The patient usually has projectile vomiting, a cerebral vomiting. In addition to that there is usually dizziness especially in frontal sinus cases which is present all the time. With mastoid in-

volvement we have dizziness also but it is not as marked as it is in frontal sinus disease. The point brought out by Dr. Rogers is that the pressure is increased at the time of these dural irritations. The symptoms of extradural irritation when we once know them are easily recognized and a great many of us fail in making a diagnosis just as was done in this mastoid case. It is very easy to diagnose these cases if one only remembers the symptoms of cerebral vomiting, slow pulse, subnormal temperature and increased blood pressure accompanied with slow cerebration.

DR ROGERS (closing). I limited my paper to perosteal irritation of the outer layer of the dura only. Between the inner layer that come in contact with the arachnoid membrane there is lubricating fluid when this area becomes irritated the patient manifests a different picture than we have had presented tonight.

With regard to spinal puncture and a Wassermann test of the blood the patient not only had one spinal puncture but three Wassermanns made each time and four of the blood all of which were negative. Two of them were made by the same man and the other by a man in Detroit. That does not mean however that the woman is not a syphilitic because she has a negative Wassermann either in the spinal fluid or in the blood. The temperature was not taken of the man to find out whether it fluctuated or not because he went to the operating room upon arriving at the University Hospital. I saw him there and within an hour after he was admitted to the hospital he underwent operation and was back in bed so we did not have an opportunity to take the temperature repeatedly before operating.

#### PROSTATECTOMY COMBINING THE ADVANTAGE OF THE SUPRAPUBIC AND PERINEAL METHODS USUALLY EMPLOYED

DR A. J. OCHSNER read a paper on Prostatectomy (See p. 84.)

#### DISCUSSION

DR DAVID W. GRAHAM. I have done the central perineal operation for removal of the prostate occasionally. But if the patient is one with a large pelvis and a thick fleshy perineum there is difficulty in reaching the prostate with the finger. Indeed the last time I tried it I failed utterly and had to make a suprapubic incision.

DR E. J. SENN. I would like to ask Dr. Ochsner whether any sinuses have followed this method of operating?

DR OCHSNER. Yes I have had a few cases of sinuses following the operation but they have been very few and not as frequent as when I have operated suprapubically. I have one patient at the hospital now on whom a suprapubic prostatectomy was done elsewhere and the sinus has persisted for twelve years.

# OPERATING-ROOM TECHNIQUE AND AFTER CARE OF PATIENTS

DR COLEMAN G BUFORD discussed operating room technique and after care of surgical patients (See p. 86)

## DISCUSSION

DR CASSIUS C ROGERS There is one technique in the operating room I have noticed many a time and that is after a surgeon has washed his hands thoroughly and is about to put on a gown he has his undershirt sleeves rolled up well above the elbow after he has scrubbed his hands and forearm almost to the elbow before he puts on a sterile gown he takes a sterile towel and dries the hands and forearm to the elbow or three inches above where he has scrubbed and the last thing he does with the towel is to dry his hands with it so that the arm that has not been scrubbed comes in contact with the towel and the scrubbed hand and the hands are in about the same condition as if they had not been scrubbed

In regard to gas pains if we did not give patients a cathartic before and after operation but treated them all alike as if they were emergency cases they would not have gas pains. If they do have pains the best way to relieve them is to introduce a good sized rectal tube leave it there placing it in contact with the enema can that has normal salt solution in it and have for two or three inches the weight of the water going into the tube having no clamp on the tube at all and when peristalsis takes place it forces down the contents of the bowel whatever it is gas or feces so that it can pass through the rubber tube back into the can and in that way patients cannot and will not have gas pains

So far as the drop method is concerned hanging the can up and dropping into the rectum water at a temperature of 105 and letting it cool down to the temperature of the room I believe it does harm and should be abandoned

A patient should not have milk after laparotomy because ether is thrown off through the stomach and if you put milk and ether together you know what happens I do not think there is anything that will cause as much discomfort as a glass of milk the day after a laparotomy In regard to irrigating the infected abdominal cavity I see no use for it and it should in my opinion be abandoned

DR D W GRAHAM I think about three quarters of Dr Buford's suggestions are very good but some of them I could not adopt at all However the trend of the whole paper is good in that it tends toward simplicity of procedure and dressings Simplicity of technique is what all should aim at It is singular how students when taught a certain method of doing things stick to it all their lives It is hard to get them to make a change An illustration of this is the instruction given in books and in the quiet room to apply big copious dressings

over a wound from which no discharge not even a drop of blood is anticipated Just enough dressing to keep the patient from scratching the wound should be the rule for such wounds

In regard to washing and shaving the parts I want nothing more than tincture of green soap and a razor

DR CHARLES STOLTZ South Bend Indiana I do not recall hearing a paper as refreshing as this for some time I agree with Dr Graham that 75 per cent of it is worth while the rest of it I should say admits of favorable discussion

As to dressings for instance after a gutter operation I use merely enough dressings to press my flaps down to the tissues underneath and after a few days none at all In general I do away with dressings almost entirely Granulation wounds drainage wounds and filthy wounds as a gangrenous appendix do better without soggy macerated dressings

Dr Buford's views on painting the skin with iodine seem to me in the line of progress It has been an almost universal ritual I no longer do it We are constantly eliminating things that were standard a decade ago If we did not make changes or modifications in our technique from time to time we would not make any progress We must individualize

Flushing the peritoneal cavity is a process that has very properly not been entirely abandoned There is no better way to remove pus or debris located deep in the cul de sac than to flush it out by inserting a catheter or tube down to the bottom of the cavity It is far gentler to flush a cavity than to mop it out with sponges

I repeat we must individualize If we adopt a fixed rule and follow it in every case we run amuck but if we look the situation over and use good judgment in the selection of resources we will be able to meet conditions

DR CARL BECK Dr Graham has said that 75 per cent of the statements made by the essayists are commendable I should say they are 100 per cent commendable — from the standpoint of the essayist—but there is more than one way to get to Rome and if you get there it matters little how you get there

In attending the clinics of different men we see surgeons go through a certain performance preparatory to and during operations which may be simple or complicated yet they all aim at the same thing In looking at this subject in a charitable way the man who adopts a certain method and achieves success by it will naturally practice it In short every surgeon has his individual method or way of doing things and all these different methods are good if they lead to success

DR CLIFFORD U COLLINS Peoria Ill I am interested in that part of Dr Buford's paper where he speaks of assistants and nurses in the operating room I have been told during the last year at least three times by superintendents that

there is a law requiring that each nurse shall have had experience in presiding over twenty five major surgical cases. I want to find out whether that law or rule was established by the training schools for nurses or by the Bureau of Registration. Such a rule or requirement is not fair to the patient. Such nurses cannot learn aseptic technique and develop a surgical conscience in that length of time.

DR CHARLES DAVISON The rules made by the training schools are for the interest of the nurses themselves and not particularly for the interest of patients.

DR A J OCHSNER The nursing problem is an important one. The Board of Registration knew nothing about what should be done. They adopted eastern rules called a number of superintendents and representatives of training schools together and made the rules these people wanted. I have recently analyzed these rules and they are as Dr Davison has said not for the interests of patients but for the interests of the nurses themselves. It is for us to see that these rules are changed. There should be nurses with especial ability trained for the operating room, others should be trained floor nurses, others for obstetrics and again others for the care of children and so on. I have recently taken this matter up with the Board of Registration and I find they had no idea in what a ridiculous position they were put. The Board made certain minimum requirements for nurses which when added together amount to thirty two months out of thirty six months for the whole service, consequently these minimum requirements are fixed and the nurses have to conform to them and this leaves virtually no optional course. You and I

have had so many other things to engage our attention that we have not given the nursing problem sufficient consideration. From now on we will have to do so.

DR BUFORD (closing) I think that the society at some subsequent meeting ought to take some action by which the hospitals will be advised to adopt the plan of stationary service for first assistants in the operating room and stationary services for internes and table nurses.

I did not attempt in this paper to cover entirely this enormous field of operating room technique and after care of patients. The time allotted me permits that I only touch upon the more salient points. From a practical standpoint these subjects have in some quarters become very complex and in my effort to show how much can be eliminated with safety and even benefit to our patients I have been quite conscious that many of you have been indulging in the same practices but felt that if the question as we now view it were summarized that what you might add in the discussion and what words of approval or disapproval you might give to my remarks might be of some service to those removed from surgical centers who in part at least are guided by your opinions and practices.

Abdominal irrigation is not dead by any means. There are some very good surgeons who use it extensively and I believe there is occasionally use for it but I regard it as a thing which it is rarely necessary to resort to and where I have seen it carried out the most it seemed to me that the patients were very much exposed to accidental infection through wetting of surrounding garments and back flooding of contaminated water.

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD MARCH 7 1919 DR THOMAS J SULLIVAN PRESIDING

### AN APPENDICEAL ABSCESS

CARL G SWENSON The patient present has both mitral and aortic lesions and enlargement of his heart. The cardiac lesions developed after two attacks of inflammatory rheumatism. Following the first rheumatic attack which occurred in May 1906 the patient was ill for 3 months. Five years later in November 1911 he had another rheumatic attack which resembled the former and which continued for 6 months.

In January 1917 the patient again became ill and consulted a physician who sent him to a hospital where he remained for 4 weeks. On several occasions during this time another doctor of great ability was called in for consultation. Both doctors agreed that the patient had rheumatism and

cardiac inflammation. He left the hospital on February 9 1917.

On February 25 1917 I was called to see the patient at a rooming house. My first impression was that he was seriously and hopelessly ill. His pulse was 100 to 130 per minute and it missed every third beat. The heart apex was in the axillary line two inches below its normal position. Respirations were thirty per minute and the temperature varied from 99 to 103 F. Examination confirmed the diagnosis made by the two previous doctors, however they had never suspected that the patient might have appendicitis.

In addition to cardiac disease the patient had gastro enteritis. His tongue was very thickly coated and resembled very much the tongue in typhoid fever. The abdominal muscles were very rigid.



and the whole abdomen was symmetrically distended. Upon percussion a marked tympanic sound was heard over the upper part of the abdominal cavity above the umbilicus. Below the umbilicus a dull and flat sound was discovered. He was unable to recall ever having had any appendiceal pain. His abdominal cavity became gradually more and more distended and in the lower umbilical and hypogastric regions the dullness or flat sound increased daily. My treatment was chiefly directed toward the patient's gastro-intestinal disease.

He became desperately ill and was taken to the Passavant Hospital on March 24, 1917. Upon his arrival there I immediately took him to the operating room and did a paracentesis. An aspirator needle was inserted through the abdominal wall of the left rectus muscle at its most prominent part at the junction of the umbilical and hypogastric regions. A very foul thick yellowish brown pus was found. The pus had a fecal odor and I feared that I might have perforated the intestines.

On the following day March 25, at 9 a. m. the patient was operated upon under local no anesthetic. A buttonhole incision one inch in length was made through the abdominal wall at the upper part of the left hypogastric region in the place of the punctation. Opening the abdomen no perforation of the intestines was found. The abscess cavity which extended upward and to the left kidney and downward to the rectum contained three pints of thick pus. It required one hour for its evacuation. By inserting my left finger into the wound I found a round channel containing pus leading across the hypogastric region through the omentum toward the right inguinal region. The patient made a rapid recovery and the wound healed in four weeks.

The discovery of the pus-filled internal abdominal sinus leading to the appendiceal region seems to confirm my diagnosis of an appendiceal abscess.

Dr. Christian Fenger had a similar case which I saw him treat in the Passavant Hospital. He first aspirated through the abdominal wall and then incised the abscess through the rectal wall.

#### COMBINATION TREATMENT OF SURGERY AND DEEP THERAPY OF INOPERABLE DEEP SEATED CARCINOMA

DR. EMIL G. BECK. This is a preliminary report on some experimental work which has been done during the past two years at the North Chicago Hospital on apparently hopeless cases of recurrent deep-seated carcinoma. Each case in which the treatment has been employed has had at least one or more surgical operations after which recurrence has taken place and in which no further surgical or any other treatment has been thought of avail.

The treatment consists of a combination of radical surgery with deep therapy. There is nothing new in this procedure for surgeons for many years

have advised treatment with following up the removal of malignant growths by deep therapy and no doubt a great deal has been accomplished with this method. The feature which I desire to bring out is this: to prepare the field for the roentgen or radium treatments by intentionally exposing the malignant area after recurrence has taken place by the most radical removal of all obviously diseased tissue.

It is a well known fact that superficial malignant growths such as epithelioma respond readily to roentgen ray and radium treatment while the deep-seated growths do not. The reason for this may be found in the suggestion that the skin, fat and subcutaneous tissue which usually overlies deep-seated cancer are filters preventing the penetration of the roentgen ray. These tissues absorb nearly all but the hard rays from the roentgen ray tube or the  $\gamma$  rays from the radium. Thus only a small quantity of the rays will penetrate deeply enough to reach the growth and the power is so diminished that instead of destroying the cancer cell the rays may stimulate the tumor to more rapid growth.

It therefore occurred to us that if we could remove the skin and all the overlying tissue and as much of the growth as feasible and leave a large area entirely exposed and then apply either the roentgen ray or radium directly on the open wound no matter how large it might be we might obtain results similar to those obtained in treating superficial growths.

The physicists teach us that the rays emanating from radium consist of three varieties:  $\alpha$  and  $\gamma$  rays. The  $\alpha$  rays constitute more than 92 per cent of all the rays emanated from radium, the  $\beta$  rays about 5 per cent and the  $\gamma$  only about 3 per cent. The  $\alpha$  rays are very readily absorbed by thin metal foil or even by the air. Rutherford says that a thickness of 6/100 of aluminum or mica or even a sheet of ordinary writing paper is sufficient to absorb completely all the  $\alpha$  rays. A great many of the  $\beta$  rays are absorbed in 5 millimeters of aluminum or 1 millimeters of lead. Only the  $\gamma$  rays will penetrate such filters. As a rough working rule it may be taken that thickness of matter required to absorb any type of rays is inversely proportional to the density of the substance.

The  $\beta$  rays however are about one hundred times as penetrating as the  $\alpha$  rays and the  $\gamma$  rays are from ten to one hundred times more penetrating than the  $\beta$  rays.

The density of tissues depends upon the close packing of the molecules which compose them. In fat for instance the molecules are very far apart while in the skin or muscles they are more closely packed and in metals such as lead or steel the molecules are extremely dense. The shadows on the photographic plate of these different substances give us an approximate indication of the molecular composition. Lead will produce a very dense shadow while wood or muscle give correspondingly lighter shadows.

It is well known that the skin itself is quite an obstacle to the penetration of the roentgen rays it produces a shadow on the roentgen ray plate and some authorities have stated that more than one half of the  $\beta$  rays are absorbed by the skin and where the underlying tissues such as muscle and fat and fascia absorb still more of the rays it is most likely that very few of the  $\beta$  rays ever reach the deep seated tumor. Thus we deprive ourselves of the greater quantity of the rays emanating from the radium. Even the  $\gamma$  rays lose some of their intensity in passing through the skin and subcutaneous tissue.

Taking these physical characteristics of the rays into account I have therefore concluded that in order to have a full measure of the effective roentgen rays reach the tumor we must remove the obstruction to their passage namely skin muscle and as much of the tumor as possible. The procedure will be best understood by the demonstration of cases. It is based on scientific principles and while the number of cases thus far treated are not sufficiently large to draw from them definite conclusions they are encouraging enough considering the hopelessness of these cases to justify its application. Usually the patients are perfectly willing to undergo one more operation because they have lost all hope of getting well.

A great many questions are not entirely clear in regard to the effect of the roentgen ray treatment. For instance the question as to why the roentgen ray will destroy the cancer cell much more quickly than the normal tissues. We have noticed that the cancer growth diminishes while the surrounding healthy tissues are not materially affected. This question has puzzled many pathologists and roentgenologists and some interesting theories have been advanced. I have a theory of my own for which I have no scientific proof but which is interesting and I believe worthy of consideration namely that the cancer cell is dissociated from the central nervous system that it grows wildly without regard to structure and appropriates its nourishment from the blood stream and thus grows very rapidly. Nearly all cells which compose the human body serve a function and the nutriment they receive is a sort of compensation for their work while the cancer cell steals its nutriment giving no counter service to the body. And like wise it does not receive the same protection from the body as the cell which is under the control of the nervous system. Is it not possible that the healthy cell belonging to the body has a certain immunity against all injury including any ill effect from the roentgen ray?

What becomes of the large denuded surface after the growth has apparently disappeared? The skin from the borders of the wound will gradually grow from the edges and cover the entire surface with the aid of the adhesive plaster method which I have demonstrated before the Society. This in itself is a proof that the growth has been eliminated

because healthy epithelial cells will not grow over cancer tissue but I have observed in the cases which I have treated that the skin will cover large surfaces which formerly occupied masses of cancerous tissue.

Whether there will be any recurrence of metastatic tumors in other parts of the body is another question. It is possible there will be. The susceptibility to cancer recurrence in what is called a cancer individual may still remain even if the growth in a particular region is destroyed. It has been stated by some observers that there are various changes in the entire body after roentgen ray treatment which may prevent a recurrence but this is too large a subject for discussion at this time.

I present this subject in this immature state merely that others may try it and help in perfecting the surgical as well as the roentgenologic technique. It certainly can do no harm to these poor individuals who have nothing but misery and death to look forward to.

My first patient I treated three years ago. I operated upon this patient for carcinoma of the breast and left the surface open. I used the roentgen ray directly on the exposed wound.

Two years later this patient returned complaining of headaches and my brother Dr. Joseph Beek who had her under his observation suspected a recurrent carcinoma in the brain. She would not consent to operation and we do not know whether she had a recurrence or not.

A second case is that of recurrent carcinoma of the neck in the submaxillary gland. The patient had been operated on three times previously and had had a rapid recurrence after each operation. She had received roentgen ray as well as radium treatment in our hospital for a long time without any apparent result. She had lost much in weight. I finally decided to excise widely and apply the rays directly to the growth. After resection of the entire tumor I made the skin flap and shifted it underneath the jaw. I left the entire site of the tumor exposed. After two months treatment the skin had grown into the entire cavity and the patient has had no recurrence now after 10 months.

The third patient is a woman physician who has cancer of the breast. About six or seven months ago I removed the growth up to the clavicle and resected the glands underneath the clavicle. I sewed up the entire wound. She already has had a rapidly growing recurrence above the clavicle. I resected all fat glands and skin above the clavicle exposing the clavicle. I left open a space 4 by 6 inches and very deep. Four weeks after the operation we applied one roentgen dose daily. It would be dangerous to apply the rays daily to the skin. We have given seven roentgen doses in seven days and the entire cavity has filled up and has become almost covered with skin. The patient has gained 4 pounds every week since this application of the roentgen ray.

I am very glad to be able to show this very typical

case an epithelioma of the scrotum. The patient was operated upon last summer. He brought me the section of the first tissue which was removed. Soon after removal the glands in the groin began to enlarge. carcinomaous recurrence. The patient was operated upon a second time and I saw him first six weeks ago. At that time he had a large hard mass with a deep crater and with typical infiltration in the groin. The case was pronounced hopeless. The entire groin was one hard mass he could hardly lift his limb and was very weak.

I did a very extensive removal taking off part of the abdominal wall and making a wound of 12 inches in length and 8 inches in width. I removed all tissues down to the vessels. Although the excision was deep I could never see the vessels because they were all involved in the growth.

At this time the wound has diminished to about one half its size. I resected the testicle. The patient is now able to raise his limb and can walk.

He has gained in weight and health. The bluish border of the wound is the neoplasia. We employ the adhesive plaster method for re-epithelization of skin. The yellowish gray discoloration is from the effect of the roentgen ray. The patient had a treatment this morning. The roentgen ray in these doses produces a sort of necrosis similar to a diphtheretic membrane which almost can be peeled off.

#### DISCUSSION

DR A. J. OCHSNER. Some years ago Dr. Crile wrote a number of papers in regard to eating malignant growths of the neck as described by Dr. Beck. Tonight since that time we have used the method in many different locations in breast cases for instance. We never graft skin immediately but give very intensive roentgen ray treatments for a week and same treatment on the open wound with the rays after operation. I am sure that by this time many of our patients are no alive who could not possibly have lived without this roentgen ray treatment.

There is no doubt at all that carcinomaous tissue will not stand severe roentgen ray treatment that is you can apply the rays very intensively just short of killing the patient and save many patients who otherwise would be in hopeless condition. Most of the patients shown by Dr. Beck I am sure would be dead now if it had not been for this treatment.

We had a very interesting case two years ago a sarcoma of a non-descended testicle. I did an abdominal section removed the tumor and found that secondary growths had extended up the entire side. I did as complete a removal as possible but I found there were nodules around the kidney. The case seemed absolutely hopeless. At the same time we thought it worth while to try the roentgen ray and gave him very intensive treatment with a thick aluminum filter so that we could filter out the rays that were likely to burn the skin. To our

surprise the carcinoma has not progressed at least up to the present time. The patient is a clerk here in the post office. He was able to go back to his work within two months and he has worked nearly two years since. We evidently killed the sarcoma or at least retarded it so that he has lived at least a year and a half longer than he would have lived without this treatment.

In the old days when we used the little coil made by the American X-ray Company we had a recurrent case of carcinoma of the breast with an involvement of the supraclavicular gland and with protrusion of the eye. We used the roentgen ray very extensively and the patient became more and more emaciated weak and cachectic. We used that little machine which seemed to be a plaything. I sent the patient home presumably to die with the eye still protruding. The next time I saw her a year later the eye had returned to normal and the case was apparently well. I have not followed her up for some time but she came in occasionally during the next few years apparently well. So I am sure that in some of these cases that seem hopeless the roentgen ray kills the malignancy.

DR A. E. HALSTEAD. My experiences with the X-ray are current and deep seated. Carcinoma has been unfortunate. I have never had a case that recovered nor that improved very much under treatment with X-ray or radium. The same has been true of sarcoma. One of the last cases I had before entering service was a woman who had very extensive sarcoma of the thigh. With the help of Dr. Case we gave this woman enormous doses of radium. Dr. Case had me make deep excisions into the thigh down to the femur. This was a sarcoma of the femur in which had invaded the femur. We gave her doses that caused extreme constitutional symptoms. These doses were repeated at intervals of seven days. In spite of this treatment the disease progressed unfavorably and ultimately caused death a few weeks after the radium treatments had been discontinued. In my experience I have never seen a sarcoma that as cured either with the roentgen ray or radium. I have seen carcinoma a little that seem to improve and I have seen some epithelioma of the skin get well but a deep seated carcinoma or a sarcoma I have never seen get well or improve under roentgen ray or radium.

DR W. R. CLEGG. I worked with the roentgen ray when I first started out in practice. While I have not had any patients who have lived any great length of time I firmly believe that I have had several whose lives have been prolonged by the administration of the X-ray. Only in two cases was it used in places where the skin had not closed over. The skin as not closed over in those cases because there was not enough left after the operation but we painted the ray healed. Both patients lived several years. I believe the same much to be done along the line of painting up the wound and applying roentgen ray to the deep parts.

DR BECK (closing) Carcinoma does not require the removal of the skin. Carcinoma reacts to the roentgen ray much more quickly. This is especially true as regards carcinoma of the glands and especially lymphatic sarcoma therefore I would advise the usual treatment in sarcoma.

But the roentgen ray alone would not have cured those cases which I have demonstrated. I have just given the reason why they would not. The gist of the whole thing is the removal of the skin and other tissues before the application of the roentgen ray.

When we operate on a case in the breast we leave a little window there that is not big enough perhaps the opening must be large enough so that the roentgen ray can penetrate all spaces affected. There is no reason why we should try to save skin in a hopeless patient for the skin will regenerate if the patient is cured and if he dies he does not need the skin.

In case of sarcoma of the thigh treated by the roentgen ray I can see why the case which Dr Halstead cited has not improved. Bone sarcoma resists this treatment. One must not be discouraged because he has not cured every case of carcinoma where he employed deep roentgen therapy.

Even without removal of the skin by proper application Dr Pfahler of Philadelphia has cured a large number of cases. With a patient who has nothing but misery and final death before him why should we not go to the extreme and see what can be done with the method which I have just brought before you.

#### PLASTIC SURGERY ON THE HEEL

DR B F LOUNSBURY During the past five years I have had occasion to care for three unusual cases of injury involving the heel. The damage sustained was of such a character as to wholly incapacitate the man from physical labor yet was not severe enough to warrant an amputation of the foot.

The problems to me were unique and it is because of the unusual features of the cases that I thought them of interest enough to present to you. A brief history of the cases with the methods employed are as follows.

Our first case received an injury in 1913 which crushed the lateral side of the foot destroying the distal end of the fifth metatarsal and little toe and tearing away the entire pad of the heel and crushing the posterior tip of the os calcis. The ankle joint and other structures of the foot were intact and the doctors in charge hoped to save a useful foot. At various times skin grafts were applied until all the raw surfaces were covered. It was found however that an area over the end of the os calcis persistently broke down and remained as an open ulcer. The foot was in this condition in June 1914 when he came under our care.

I had never before transplanted a flap over the

end of the heel but after placing the foot in various positions decided that a flap could be elevated from the back of the thigh. This was done and the heel was held in a cast against the back of the thigh for 14 days when union was firm enough to cut away the flap. Ultimately an excellent covering was developed for the heel. When the patient was first permitted to step on the foot he was provided with an arch support which helped to take some of the pressure from the heel. In September 1915 he was again able to resume his work and has never been obliged to lay off a day since that time on account of any trouble with his heel.

Gradually the transplanted skin has toughened to meet the demands of the pressure placed upon it and he now has a very excellent weight bearing surface in this transplanted tissue.

It was necessary to place the patient on his face with his leg crossed behind him and hold him in a cast. The disfigurement from this was extreme and I thought at the time if occasion ever arose for a similar operation that I should try to avoid keeping him on his face as the position was difficult for the patient and made it difficult to care for him.

In January 1916 we received another patient who had the right leg crushed below the knee and his left heel crushed. The os calcis was cut through about midway between the anterior and posterior ends. The entire padding and soft tissues about the heel were destroyed. The question arose at that time of amputating the foot but the doctors in charge decided to try to save it. The patient came under our care some time later with an ulcer on the heel which could not be covered with skin because of the dense scar tissue. Two and one half years after his injury he was still unable to use his foot and was walking with an artificial leg and a pair of crutches. In July 1918 we performed a flap operation to cover the heel. Hoping to obviate some of the difficulties encountered in the first operation we sat the patient up and crossed his legs in front of the thigh holding it in a cast.

This was a great improvement so far as the position of the patient was concerned but we found later that the pressure of the external malleolus over the front of the thigh was so great that it produced a necrosis that reached to the femur and necrosed the skin over the external malleolus.

It was necessary to take a large amount of flap away in order to cover this defect over the malleolus. Subsequently we skingrafted the area over the front of the thigh and there has been a full restoration of the function of the quadriceps muscles and tendons.

About six months following this operation a cyst was brought to my clinic in County Hospital for a curettement of the os calcis because of a persistent ulcer on the heel. Inquiry into the history showed that the patient two years previously had had the end of his heel crushed off in an accident in Mexico and though skin grafts had been applied

an area of about one inch in diameter remained as an open ulcer. A roentgenograph showed that the periosteum over the end of the os calcis had been damaged and had produced a thickening in this region.

We decided that the only way to get a serviceable foot was to put a transplant over the denuded area. With our experience in the two previous cases we hoped to make this patient the most comfortable and avoid the sloughing which took place in the second. We turned up the flap from the front of the thigh but padded well to keep pressure off the external malleolus. We found when we advanced to cut the flap down in spite of all our precautions necrosis had taken place as in the second case. Despite this we have secured a healing which now seems certain to give a good functional result.

DR CARL DAVIS. I have had but one case similar to that which is mentioned. Our patient was a stocky heavy muscled individual and as we drew out his leg in the various positions it was seen at once that the foot above the knee would cause him much pain. We applied a plaster cast before the flap was removed as an experiment to see how he would stand the position. We were compelled to take off the cast in a few hours. We eventually compromised and brought the heel up to the middle of the leg and took the flap off the calf. If you will place your own foot in this position you will see it is not tiring and worked out well with our patient. We kept him under observation for a year. The distal portion of the flap did not heal well and gradually the plantar fascia grew backward. It was the most remarkable case of regeneration I have ever seen. It made me think of the experiments we used to have in zoology where we cut off the antennae and nippers of the crayfish to see how far back we could go before regeneration failed.

The original lesion in this man was due to a railroad accident where the plantar surface of the os calcis and most of the soft parts of the sole of the foot were crushed off. When he was finally discharged from observation the tip which we had taken from the calf had diminished in size so that it was not much larger than a silver dollar. The plantar fascia had regenerated for a distance of almost three inches.

DR EMIL C. BECK. I only wish to say that the os calcis can be removed especially in cases in which the disease has destroyed the bone entirely or partially. Even after complete removal of the os calcis the patient may in time have a useful foot. There seems to be a tendency of the os calcis to regenerate just as after removal of a rib another rib will soon grow in its place. The growth of new bone is probably due to the fact that there remain in the surrounding tissue some parts of the periosteum. I have two such cases and there seems to be almost no deformity left.

DR CHARLES DAVISON. It was my opportunity to be an interne in the service of Dr. Christian

Fenger and to see some of the earliest successful flap plastic work done by him. I have since done quite a bit of this work. I remember my first case in which the patient had lost the heel. In that case I took the skin from the dorsal part of the foot and turned it down as a flap. The flap was not thick enough to give as good a result as I wished but it was successful and the patient is walking today.

The next case I treated according to the method described by Dr. Carl Davis. I put the heel to the calf of the opposite leg. That is the method I have followed since. I have not found that the patient suffers a great deal with the foot in that position.

I have put the patients in very solid plaster casts encircling both legs so that they are solidly attached to each other when there is no movement. The results are little pain. I think that all of these years have demonstrated very thoroughly that the Thiersch graft or any thing else will not stand the attrition of use on the sole of the foot or on the palm of the hand.

There is a patient today in my ward at the County Hospital who illustrates that very nicely. He is an old chronic case of years of age. Twenty years ago he had a railroad accident in which his heel was crushed off in much the same manner as in the case that was shown tonight. A skin graft by the Thiersch's method was applied and the wound was successfully covered. However the patient walks for only a little time until the heel grows ulcerous and then he rests the foot until it heals over again. He has repeated this history for twenty years.

DR CARL BECK. The results that Dr. Lounsbury has had are really marvelous considering the location of the transplantation.

Good results for transplantations can be secured only when tough skin is used for the transplant.

A method which I have used and which was originally described by Braden of New York many years ago gives excellent results. A flap is transplanted first to the arm where it is left long enough to establish good circulation. It is then transplanted to the heel merely transferring the flap from one position to another through the medium of another locality. I have used this method several times and it works very well.

DR A. E. HALSTEAD. We have had a number of the cases and never had any difficulty in getting the flap from the inner side of the thigh. I put the patient in a cast incorporating a piece of wood in the cast to support the leg. I had two cases of malignant disease of the heel. One a carcinoma in an old woman and the other a sarcoma in a young man. In both cases I amputated the heel cutting through the os calcis and soft tissues. A pedunculated flap was lifted from the inner side of the opposite thigh and the elevated margin attached to the heel. At the time the flap was detached from the thigh a piece of fat was inserted under the flap to serve as a cushion and protect the flap

from pressure. In the case of the man the mammary gland was utilized at a free transplant. In the woman a piece of fascia and fat was taken from the buttocks.

In two cases of traumatic loss of the heel like those shown by Dr. Lounsbury, I did the same operation using the flap from the inner side of the thigh. I have never had any difficulty and never had any patient complain of any pain or discomfort from the position of the foot.

Contrary to Dr. Beck's statement, I believe that skin from any part of the body, if you remove with the skin the underlying fascia, will be sufficient covering for the heel if underneath you place a cushion of fat. Skin very quickly assumes a rugged character and becomes thick.

DR. DAVIS: I think Dr. Beck misunderstood me. I transplanted from the rear of the calf to get plenty of fat.

DR. LOUNSBURY (closing): Dr. Beck speaks of taking a transplant from the arm. My objection to this would be that we would run the chance of putting quite a scar on the forearm. In one of these cases we had to have a very large flap to cover the heel. The flap would probably be as large as the whole forearm. In transplanting these flaps I find that as soon as the skin is turned up from its normal position it shrinks very materially and much would be lost by shrinkage unless the flap were transplanted and held in its new position by sutures.

DR. CARL BECK: I do not mean to take the flap from the forearm but to take the flap first from the thigh and transplant it to the arm. That does not take anything away from the arm.

DR. LOUNSBURY: I will bear Dr. Beck's suggestion in mind in case I have occasion again to treat such a condition. My reason for selecting the thigh instead of the calf of the leg was that fact that a thicker pad of fat could be secured in the thigh than in the calf. I presume fat however could be supplied from other sources as has been suggested.

The pain these patients suffered however from holding the heel to the thigh was not intolerable and the young Mexican who was rather loose jointed complained very little. The other two men however required considerable opiate.

#### AN ADVANCE IN THE TREATMENT OF DIABETIC GANGRENE

DR. L. L. McARTHUR: Four years ago I brought to this society nine cases of gangrene of the foot of the type of thrombo-angitis obliterans. These nine cases had been cured, their gangrene checked, their line of demarcation formed and the feet made well without amputation.

Since that time by the application of the treatment which Koga has recommended for that form of gangrene of the young, I have experimentally tried the Koga method in cases of diabetic gangrene that have been transferred from the medical depart-

ments of the hospitals with which I am associated. To my surprise I have found that the same effect holds true in diabetic gangrene as holds true with the thrombo-angitis obliterans. In August of last year I took to the Tri State Medical Society at Madison, Wisconsin, illustrative cases of diabetic gangrene which had been so cured. I had two cases for exhibition at the clinic this morning.

For the benefit of those who may not be familiar with the treatment that Koga recommended, I would like to epitomize it briefly.

Mavesima, pathologist in the University of Tokyo, showed in 1910 and 1911 that all cases of gangrene had an elevation of the viscosity of the blood. Acting on the hint contained in this contribution to the experimental research by Mavesima, Koga tried to reduce the viscosity of the blood.

Posselle had shown in the experimental laboratory and in the physical laboratory that the flow of fluids through capillaries is inversely proportional to the square root of the viscosity of those fluids. If the viscosity of the blood is reduced one half the flow is doubled. In other words a capillary will be multiplied four times in functional capacity by reducing one half the viscosity of the blood flowing through it.

The result of Koga's experiments were presented to the Japanese Surgical Society in 1911 with thirteen cases cured, one to three years with two recurrences and cured simply by arresting any further progress of the gangrene, lifting off the dead tissue when the line of demarcation had formed or if the end of a phalanx or metacarpal bone stuck out amputating that with the bone scissors.

In Michael Reese Hospital where cases of thrombo-angitis obliterans are more frequent than in the other hospitals of our city, because the disease is one peculiar to the Jewish race, opportunity came to me to try out this treatment. The results have convinced me that it should always be tried before resorting to amputation in any case of gangrene of the thrombo-angitic type with the exception that if the patient be profoundly toxic from not only the gangrene but the absorption of mixed toxins associated with the gangrene then it might possibly be not safe to try it.

Dr. Edwards referred to me for amputation a case of diabetic gangrene with profound sepsis, high temperature, soggy and infiltrated foot and calf of the legs—a delirious almost unconscious patient. The patient was in such desperate condition that I felt justified in waiting and while waiting trying the Koga treatment.

Koga found that by simply diluting the blood by hypodermoclysis with a thousand cubic centimeters of ordinary salt solution he could dilute and thus reduce the viscosity of the blood so markedly as measured by the viscometer that he decided to try it in the gangrenous cases mentioned. By using it once a day for two or three weeks and then every other day then two or three times a week, he secured his results.

Trying this same plan on a diabetic then with local antiseptics and the crowding of his vessels with fluids three liters a day we succeeded in producing a line of demarcation on his foot. It ultimately healed and he was able to use the limb to walk on.

Having that success the next cases of diabetes that I saw I also so treated. I reported the result of four such cases at the Great Lakes symposium. In the course of the past four or five months I have had five more so that I now have nine cases of diabetic gangrene in which the line of demarcation has been outlined—the ultimate sloughing of the dead tissues from the living—the rising up of a suppurative mass with the untreated thromboangiitis with the diabetic gangrene, but the actual formation of pus and that process which accompanies the formation of a line of demarcation we succeeded in obtaining. It is then to encourage the trial of this treatment before resorting to amputation that I appeal before you.

Time after time we have all of us amputated these gangrenous limbs. We have always felt that if two or three so that major portion of the foot or even amputated we should amputate to the lower third or to the middle of the leg to secure a proper area for amputation. This kind of feet we have sacrificed but I can now show men able to walk around upon cured feet of this kind.

It looks then a simple procedure and you all feel at once that you will adopt it. Do not let it be however if you do not intend to give it a fair trial. It means for me ten to twelve weeks of treatment. The earliest that we have gotten results is in four days. It means a long tedious process. You will find as I found that there will be considerable difficulty in getting your patient to submit favorably to the first two or three weeks of hypodermoclysis of the upper and cubital regions under the skin of his brachial or his chest. You will have to hide the needle as I did and make your injection into the vein of his arm. But after you try that for three or four weeks it is difficult to puncture the vein. Then what will you do?

An interne of mine Dr. Davenport suggested that we administer the solution through the duodenum using the Rehfuß tube that I have the patient swallow this very small Rehfuß tube inserting it down to the second marking on the tube which means that it is almost in the duodenum. With this method we found we could put in a liter of solution three or four times a day. The patient could sit and smoke a cigar or read his paper in his room or so after he had his meal without any interference with the digestion and without the fullness that would come from swallowing the water glass by glass. After one has taken two glasses of water he begins to feel uncomfortable and after three or four glasses are taken there is distress in the stomach. We have had five patients at a time sitting and gossiping all of them taking this treatment and all perfectly happy except for the fact that they had to urinate frequently.

Koga recommended the use of normal salt solution. I believe that Locke's or Ringer's solution is an improvement on normal salt solution. While diluting the blood to reduce its viscosity the blood is robbed of those chemical elements which are very readily incorporated with the salt solution by using the normal physiological solution of the laboratory.

In the past three months I have cared for a patient who had been crushed across the continent because the surgeons of California concluded to amputate his foot on account of the impending gangrene of diabetes. We have all seen the little dark spot on the soft tissues and the coldness and poor circulation and the pain which impends before gangrene comes. Just then is the time in which to save perhaps the patient's life but surely a toe or two. This I have done three or four times in the last 3 or 4 months. I am sure that you will find it quite possible to do so.

In two cases of diabetic gangrene I have not had good results. In these cases I found on taking X-ray pictures of the limb which had to be amputated after arterial therapy the arteries were perfectly calcareous per se. In such cases I do not believe one can hope to change the circulation sufficiently to secure a favorable result. I would therefore suggest that prior to beginning treatment which must necessarily tend over a period of a number of weeks that an X-ray picture be taken of the diabetic gangrenous extremity. These calcareous blood vessels are so reduced in caliber that you cannot hope to accomplish much.

If ever in the diabetic of the younger period of life where there is absence of the calcareous changes in the arteries you still have the comfort to know that many cases can be saved. I hope you will try it.

Dr. McArthur. I have been asked what effect this flushing of the vascular system in the kidneys had on the diabetes. I want to say that the sugar is washed out of the blood in great quantities and diminishes and disappears far more rapidly than by the simple dietetic treatment. Undoubtedly the sugar going through the kidneys and through the skin and through the bowels of such large quantities of fluids dissolves the sugar and carries it out of the system without sugar being taken back into the body by the kidneys and the bowels.

Since starting this treatment a day call of my medical colleagues in the hospital staff into consultation in connection with some experiments have been made. The blood of these thromboangiitis cases and while they show no sugar in the urine they have a high glycemia and an increased amount of sugar in the blood. It is their interesting observation and although they do not show it in the urine that it has above the normal amount in the blood.

Dr. Halsted spoke of gangrene of the foot. I have been finding more particularly in the diabetic gangrene of the diabetic type and the gangrene of the foot. When the gangrene has spread a

to the leg I imagine that amputation will be the better procedure

I want particularly however to emphasize the importance to your patient of the first sign when he comes to you of that little black spot on one side of his toe or under his toe and the impending gangrene which is there threatening because then you really protect him from the disaster which ultimately overtakes him if this be not recognized

Now as to the gangrene that comes from the arteriosclerosis Gangrene unfortunately is associated in all of your minds with a change in the blood vessel condition We have always thought in blood vessels when we have thought of gangrene We must now however think of changes taking place in the blood itself and not particularly in the vessels but changes in the blood will make the gangrene changes in the innervation will make the gangrene changes in the vessel walls will make the gangrene There are three different things to be considered viscosity vessel walls and the innervation

Now I do not think there is any reason why the patient may not drink this fluid and two of these nine cases have been able to get their three quarts of water by drinking Those who have tried it have had to force themselves however to a considerable amount of discomfort in taking fluid through the stomach without the tube You can not very well get a patient to drink a gallon of fluid a day but you can get a gallon in through the Rebuffus tube You can easily get them to take a quart once a day or even two quarts

A patient whom I had to show you at Michael Reese hospital this morning is one of the ones who drinks his three quarts a day The process does not seem to be as effective when they drink the water as when it is taken through the duodenum Whether it is changed by the acids of the stomach or partly by absorption while in the stomach I do not know

#### DISCUSSION

DR A E HALSTEAD In a large percentage of the cases of gangrene of the foot (Schede places it at 50 per cent) occurring in diabetes the onset of the gangrene is determined by an obstruction that is located at the bifurcation of the popliteal artery This obstruction is due to an obliterating endarteritis If in a given case the gangrene has reached the dorsum of the foot and there is no pulsation in the posterior tibial artery we are justified in assuming that the obstruction is in the popliteal artery In these cases the method of treatment recommended by the essayist could be of little avail in effecting a cure or in delaying the process Under these circumstances an amputation is the only remedy

DR SULLIVAN On the subject of drinking water I might say that one time I suffered with peritonitis and after the first part of the attack was under control I had no trouble in drinking one gallon of water a day and I kept that up for over a week by using plain water like some water without min-

erals After trying a lot of waters I finally asked for Waukesha water and then a gallon a day was a scant amount and after a while I wanted more no inconvenience whatever

I have tried that on patients very often Take peritonitis following a case of appendicitis where they want to eliminate and give them Waukesha water and they will drink it without any complaint There seems to be a difference between water of that kind and lake water I remember when I was a boy we used to try a trick of drinking water to see who could drink the most and from certain wells or springs we found we could drink the water much more readily than from others So probably you can get your patient if you have a drinkable water that absorbs readily to drink a gallon a day without trouble

#### A CASE OF TUBERCULOSIS OF THE KIDNEY

DR HUGH A MACKFERNIE W P H age 33 came to my office October 17 1910 complaining of first severe hæmaturia—clots and fluid one half quantity passed being blood second sensation once or oftener a day of something passing down the left groin from the lumbar to the pelvic region with feelings of uneasiness and desire to urinate followed shortly by urination of bloody urine At no time did these sensations constitute a pain although there were occasions when they were markedly severe third loss of ambition appetite strength and weight fourth headache as of a binding sensation around the head accompanied by a feeling of emptiness and dizziness with ringing in the ears

The father died at the age of 38 of bowel trouble contracted during the war The history pointed to a tubercular condition in both the abdomen and the chest but the patient is not clear on this point The mother aged 52 is living and well The patient has no brothers One sister is living and in excellent health No man in his father's family as far as known has lived to be forty years old

The patient has had the diseases of infancy no specific history He has almost always been healthy except for the attacks of hæmaturia he smokes regularly 3 to 6 cigars daily He drinks occasionally but never to excess At the age of seventeen he had an attack of typhoid fever with a severe relapse Following this for ten years he had a semiannual attack of chills and fever and malaise then instead of the usual attack he had one of hæmaturia For the succeeding ten years he had a semiannual attack of hæmaturia varying in severity and lasting from one to three weeks During this period he has had treatment of various sorts hygienic and medicinal with little or no results The results secured seemed to be coincident with rather than due to the use of any special treatment The bleeding would commence suddenly without apparent cause





improvement in the hemorrhage the vaccine had produced no reaction and the patient gradually lost ground.

On November 20 blood examination showed hæmoglobin 30 per cent red blood cells 2,400,000 white blood cells 5,800. Urine examination showed no sugar no casts blood in quantity and a few pus cells. Operation was again proposed and accepted.

On November 21 the patient was given first 700 cubic centimeters of saline solution intravenously and was operated upon under nitrous oxide ether anaesthesia neither of which was well taken. A diagonal lumbar incision was made on left side to expose the kidney which on account of firm adhesions was with difficulty brought into the wound. The capsule was split and readily stripped off. On the convex surface was seen a dark, foggy mass which was cut through and a small amount of dark blood ran out. The kidney was cut from pole to pole through the convex surface to the pelvis. On the cut surfaces were seen the small concretions shown in the specimen. A careful examination of the pelvis revealed no special ulcerated bleeding point which might be ligated and it was decided to do an excision. A ligature was applied to the stump but it slipped off and considerable hemorrhage ensued. The bleeding points were rapidly clamped and these clamps were left on for two days. Three silk worm gut sutures for coapting muscles and skin were inserted. Dressings were applied and the patient was removed to his room. The pulse was 112 and of fair quality. The patient was given strychnine sulphate 1/30 grains every four hours normal salt solution high per rectum continuously and liquids by mouth. Morphine sulphate was given (1/4 grain) if required for restlessness.

On November 22 morning temperature was 99.8 pulse 94. The patient passed a comfortable night. During the day the pulse and temperature rose. At 7 p.m. temperature was 103 pulse 112 and of a fair quality.

Urine examination 53 ounces specific gravity 1.017 albumin acid blood present and pus absent. The urine was brownish red with red brown amorphous urates no casts.

During the night of November 3 the temperature and pulse rose and the patient grew worse. He was given 500 cubic centimeters of normal salt solution intravenously at 6 a.m. with slight temporary improvement. At 8 a.m. the temperature was 105 pulse 142 respiration 36. Diaphoresis was profuse. The hands and feet were cold. The patient was in a stupor from which he could be roused with difficulty. The ocular reflexes were lost and the pupils dilated. Cheyne Stokes respiration for some four hours. The patient was given 600 cubic centimeters of normal salt solution intravenously with no apparent effect. The blood which escaped did not clot. At 12:30 a direct transfusion of blood was given using the Crile tube. Within a half hour the patient opened his eyes and recognized his nurse but



Fig 1 Specimen Dr Lounsbury's case of tuberculosis of kidney

sank into a stupor. At 2 p.m. he was again conscious and asked for lemonade. The pulse gradually came down and at 5 p.m. his temperature was 100 pulse 108 respiration 36. The next morning the urine which had been almost clear became bright cherry red in color. A few blood cells were present much hæmatin. This condition was evidently due to hæmolytic following the transfusion and it cleared up during the day.

From this on the patient made an uneventful recovery leaving the hospital December 23, 1910 at which time the blood examination showed hæmoglobin 40 per cent red blood cells 765,000 blood pressure systolic 115.

There was a sinus tubercular in appearance which persisted seven weeks. The pathologic report on the kidney was made by Dr E. R. Le Count (See Figs 1 & 2).

The kidney is slightly smaller than normal. It is smooth externally except for one region to be described presently and the capsule strips easily. Opposite the middle of the kidney on the posterior surface there is a depressed region which extends from the hilum nearly to the outer convex border. This region is 2.5 centimeters long and 1 centimeter wide. In its deeper parts the cortex is entirely absent. On the outside of the kidney this region is red and its margins are beset with fine gray elevations not unlike milium tubercles in size and other features. Directly beneath this depression there is a cavity in the cortex formed by the enlargement of one of the calyces. This cavity has an average diameter of 1 centimeter. The lining is brown and there are scattered white gritty masses deposited on the lining here and there. The renal tissue surrounding this region has lost its normal appearance: there are no striations of either cortex or pyramid seen upon the surfaces made by sectioning and the junction of the cortex and pyramid is not clearly defined. Externally this region in the kidney looks like an infarct in some stage of healing and the alterations in the renal tissue about the cavity also indicate some degree of chronicity. The lining of the cavity (or dilated calyx) is beset with minute pin head sized elevations.



Fig. 2. Section of kidney showing a large, dark, necrotic area in the upper pole, likely a calyx, with surrounding tissue appearing normal.

In a calyx in the upper pole of the kidney there are a similar change. Here the chief alteration is an absence of the tip of one of the medullary pyramids. On the surface made by sectioning this pyramid at right angles to its longest axis is this defect. It tends proximally with reference to the circulation of the urine to a point midway between the base and the tip of the pyramid that is the necrosis extends outward from the calyx and the lining of this accessory cavity is like that of the other cavity brownish and finely granular. Similar but even less marked changes are present in one or two other calyces. The lining of the renal pelvis is smooth and unchanged. The cortex measures from 3 millimeters to 6 millimeters in thickness. There are no other gross lesions in the kidney.

**Microscopical examination.** The usual features of a tuberculosis of the mucous membrane lining the renal pelvis and calyces are met with in sections prepared for microscopical examination. From the surface to and the more normal tissue there are met with a zone of necrosis which varies slightly a layer of granulation tissue which is very poor in blood vessels and where these two meet the nuclei of the cells are arranged at right angles to the surface and parallel to one another in a manner quite characteristic of tuberculous lesions in this location. Giant cells are infrequent.

On December 8 he began the use of tuberculin O. T. 10,000 milligrams. The patient had a severe chill his temperature rose to 104 and he was markedly prostrated. It took several days for him to recover. On January 8 1911 the patient left for the south. He returned a month later much improved. On February 6 10,000 milligrams O. T. produced a mild reaction with malaise and uneasiness no chill no rise in temperature no increased pulse rate. This dose was repeated six times and then gradually increased. He was given treatment several months and improved rapidly.

In 1905 the patient complained of trouble in the dorsal region at the seventh vertebra. As this increased deformity was in Roentgenography revealed a tuberculous necrosis of the body of the seventh vertebra and involvement of the intervertebral disks above and below. I performed an Albee operation from which he recovered nicely. His deformity has not increased and his pain has ceased except at the upper end of the transplant here only fibrous union has taken place.



Fig. 3. Dissection of the bladder showing a large, dark, necrotic area, likely a calyx, with surrounding tissue appearing normal.

On March 1910 the patient returned for examination. He appears to be well nourished looks well and weighs 145 pounds. His spine shows some deformity but there appears to be no active process present. The lungs are clear the heart good the abdomen negative and the kidney functional to the normal. Urine specific gravity 1000 clear acid urea 0 per cent albumin trace no sugar no casts pus rare. Cystoscopy showed the left ureteral opening contracted. There was no tubercle but an old healed ulcer on the tri-ureter. The right ureteral opening was normal. Urine came from it regularly. Animal inoculation was negative.

Of the presenting symptoms in renal tuberculous cystitis with an irritable bladder and painful urination comes first in frequency. The patient reports a burning in the bladder which is found not to yield to ordinary treatment. Crabtree and Cabot<sup>1</sup> say the bladder symptoms are first in 48.5 per cent of cases renal pain is next in 35.7 per cent of cases hematuria in 4 per cent. McKenzie<sup>2</sup> reporting the work at the Royal Victoria Hospital in Montreal gives cystitis as the first and foremost symptom then hematuria in 15 per cent of cases pain over the kidney in 1 per cent. Constitutional symptoms of chills fever night sweats loss of weight are seldom present. Tubercle bacilli<sup>3</sup> was found in 80 to 90 per cent of cases. The only indication symptom in this case is the hematuria which was very marked. The diurnal was about half the quantity passed. Examination revealed slight urinary changes with pus casts and albumin. Even cystoscopy showed the ureteral orifices and bladder without tubercles after many years duration. Its mode of onset and progression is similar to that of other reported cases but the duration of attacks and of years during which they occurred were more than I have seen recorded. It is the type of case that has been often classed as essential hematuria. Lyons<sup>4</sup> cites one case in which hematuria was the only symptom. It first appears in 1908 returned in the spring of 1913 and again in the fall of 1911 when it lasted seven weeks. He states that an early symptom is a polyuria. Unfortunately these symptoms of irritable bladder and polyuria appear to be of such minor importance.

C. M. L. C. H. & G. Gynec. & Obs. 1911  
M. H. C. M. L. 1911  
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that our patients either doubt the possibility of our suspicion or will not accept the expense of further examination and investigation or the necessity is not impressed on them. Not until the case has well advanced do they reach the surgeon or urologist with an intense desire to get relief. Every case that presents a slight amount of pus should be thoroughly examined for a possible latent tuberculosis for many of these cases pass the stage of assistance because of the lack of pronounced symptoms. Bugbee<sup>1</sup> reports a case with no symptoms. Tubercle bacilli were found by chance in making a complete physical examination. The bladder and ureters were normal. The quantity of urine from the left kidney was double in amount that from the right. It was pale and there were found albumin, pus and blood. The ureter output was low. Tubercle bacilli were present. Five years later a nephrectomy was performed at the time the patient was operated upon for costovertebral pain and gastro intestinal symptoms. The kidney was found to be enlarged and it had numerous walled off pockets containing a thin serous fluid.

The duration of development in the case reported is quite striking. At the age of seventeen years the patient had his first attack of chills and fever of a mild indefinite type. These attacks came on each spring and fall, lasted for a few days and passed off leaving him apparently as well as before. Should these attacks be regarded as the result of early focal infection or as the breaking down with absorption of a necrotic mass? From the gross pathology either might be a natural conclusion for besides the areas of recent ulceration we have small areas showing some evidences of fibrosis and incrustation with urinary salts. It is unusual to find these cases running such a prolonged course. This patient did so because his lesions were all small and became encapsulated and quiescent. He would not in earlier years accept a thorough examination for diagnosis maintaining that each attack was similar to and would end as had previous attacks. I know that because five years before he became my patient I saw a specimen of his urine and urged his physician to bring him to further investigation but this could not be done. This gives him a developmental period of twenty years and a post operative period of eight years and four months. On the other hand Pousson<sup>2</sup> reports a case in which there were no symptoms for eighteen years but returned. Crabtree and Cabot report the following cases well after operation and one in 18 years one in 15 one in 13 two in 11 one in 10 years. The longest period of development of symptoms for any case in their series was 10 years.

This brings up the question of a cure and what it constitutes. Shall cure be judged by a clinical or pathological standard or both? Naturally human patients cannot be sacrificed as animals can to ascertain their condition. Only in so far as we find

these kidneys at operation or at autopsy can we arrive at conclusions.

Dock<sup>3</sup> says I have not a full analysis of all the cases but the total impression one gathers is that true healing of renal tuberculosis is rare. That it has lesions little susceptible to healing under general treatment but has a strong tendency to complete destruction of the kidney in which however the disease may be shut in for a time with constant danger of local or general tuberculosis at all times. Heitz Boyer<sup>4</sup> reports a case supposed to have been cured. Twelve years later the patient had a swelling in her loin but as she had no physician she had gone without a diagnosis. Eight years later she had a nephrectomy and there was found an enlarged caseous kidney in which the renal tissue was wholly destroyed.

Keyes reports a case which had a nephrotomy done by McBurney in 1895. Seventeen years later the patient died of carcinoma of the gall bladder and liver. Autopsy showed the kidney entirely destroyed by a tuberculosis which had been progressive probably from the time of the nephrotomy.

Zukerkandl<sup>5</sup> says induration of a tubercular kidney and hardening of the parenchyma may be taken as a local recovery but never absolute.

We are therefore led to accept our clinical signs and symptoms as proof only of probable recovery with a certain reservation prompted by operative and autopsy experience. We are further confirmed in our reservation by our belief that tuberculosis of the kidney is always secondary in origin and that its route of arriving at the kidney is hematogenous. It does however tend to focus in the kidney as its early metastasis as shown by Baumgarten in his experimental and postmortem work. If tuberculosis is found in one kidney we have every reason to suspect that it is or will eventually be in the other unless we eliminate the primary focus. On the other hand it may be clinically shown to be absent from the second.

We are therefore bound to accept as evidence of probable recovery those cases that are improved symptomatically knowing full well that in any one case the absence of symptoms may be due to a fibrosis or to the encapsulating of a caseous focus that will break down or ulcerate at any time. On the other hand we must remember that the condition may be unilateral and that nephrectomy may remove the only active focus in the body.

The treatment of these cases is without doubt surgical i.e. nephrectomy. This is the only means of removing a focus which may be producing a general infection. The time for operation may be a matter for consideration but seldom calls for delay further than to ascertain the status of the opposite kidney. We should not temporize with tuberculosis in the hope of producing a degree of immunity. If such may be produced at all it has

been done by the infection present. If this does not do it surely no heterogeneous material will do so.

What if any value can be gotten from a nephrectomy in a hematogenous infection. Balfour states that 80 per cent of cases are lateral at operation but that 75 per cent are bilateral at autopsy. Israel<sup>1</sup> has shown that the infection locates in one kidney first and later in the second and that this second infection is not from the first kidney but from the extra renal primary focus. In other words if we take these cases early and perform a nephrectomy we have some prospect of checking the disease provided its primary focus is in some organ susceptible of healing and not in the opposite kidney which is not so susceptible.

Kapsammer<sup>2</sup> gives more conservative figures and says that in 191 cases 67 (35 per cent) are unilateral and 124 (65 per cent) bilateral.

Loer says: Our impression from symptoms and findings in diagnosis is that early and sometimes late renal tuberculosis is unilateral at the time of operation but on the other hand autopsy records show that about two thirds of cases are bilateral.

In other words tuberculosis of the kidney is generally unilateral early but if allowed to run its course almost inevitably becomes bilateral. It would seem that the case reported was an evidence that it may be unilateral for at the end of eight years and four months we have at least no clinical evidence that the other kidney is involved even

in the face of the fact that since the first operation we have had an active process in the spine.

After operation the usual hygienic treatment should be persisted in supplemented by the use of tuberculin. The value of the latter is questioned by many and perhaps rightly so in renal tuberculosis. Walker<sup>3</sup> says tuberculosis relieves symptoms but does not cure. Wildholz<sup>4</sup> used tuberculin for from 2 to 1 months in these cases and reports general improvement but no healing of the kidney was seen.

On the other hand if the active renal focus is removed the extra strain is taken off the patient the resisting powers are permitted to work on the primary focus and a cure may be expected as in any tuberculosis.

### CONCLUSIONS

1. Tuberculosis of the kidney is probably primarily unilateral but if allowed to persist may become bilateral either from infection from the first kidney or from the primary focus.

2. Tuberculosis of the kidney may persist for many years without bladder involvement or other evidence to attract our attention. A mild persistent cystitis should arouse our suspicion.

3. Early excision is called for and subsequent treatment as for tuberculosis at any point of the hygienic tuberculin.

4. We have no antemortem positive proof of a cure. Our only evidence is the absence of symptoms after a reasonable length of time and this postmortem experience makes us doubt

I 1 1 1 U 1 1  
Am mm Am J U 1 0 1  
Low T Am U 1 A 6

W R F  
Wildholz W med W h h 9

# AMERICAN COLLEGE OF SURGEONS

## CONCERNING HOSPITAL STANDARDIZATION

TO define hospital standardization in a negative way it is not an effort to make hospitals alike in form of government of administration or of equipment it does not seek to enforce conformity to any given mold nor to limit originality in any phase of hospital work.

Hospital standardization means *thinking alike* on the part of doctors hospital trustees hospital superintendents laboratory workers nurses and the public upon the aims and utility of hospitals. It means that every patient in a hospital is entitled to the most efficient care known to the medical profession and that every hospital believes itself morally obligated either to render such service to its patients or to state frankly to the patients that it cannot do so.

The entire program of hospital standardization undertaken by the College is a gift to hospital and to the medical profession. But in so far as any such program is one of reform that program may or may not in a true sense be a gift. In what way then is the effort of the College a gift? This question is important. The answer to it lies in the method itself with which the College has taken up the work.

There are two methods by which hospital standardization may proceed. The first is scientific the second human. These methods are not entirely exclusive one from the other but the difference between them is nevertheless the difference between a gift of lasting worth as against an uninvited interference of doubtful value.

The scientific method is concerned with its own point of view. It is interested in the outcome of its actions on others. It assumes that men and institutions are to be governed and that having determined upon a *best* form of government there is no right of appeal by the

governed. Under the scientific method hospital standardization would say to the hospitals: I have analyzed correctly my own duty toward you and you must therefore accept all that I do to you. You may not like it. Here is a plan for the betterment of hospital service. You must co-operate by accepting it. It will do you good.

The scientific method has wrecked many a worthy project of reform. It prejudices men against all systematic progress. It is a prevailing foolishness among us which keeps the millennium undated. It is a blunder which the College in its relations with hospitals and the medical profession resolutely determined not to make.

The human method never forgets the point of view of others. In fact that is the only point of view which it knows. It assumes that men are intelligent and open minded. But it is not sentimental or merely sugar and spice and everything nice. It values straight thinking and accurate data quite as much as does the scientific method. Under the human method hospital standardization says to hospitals:

Here is a plan for the betterment of hospital service. It is a plan which grew out of our own heads and hearts after conscientious and long effort on the part of all of us to devise such a plan. Will you please consider whether or not you will accept it? Will you become a rival for the light under the terms of this plan? This is the method with which the College took up hospital standardization.

That some concerted action for the betterment of the practice of medicine is needed no one questions. The opportunity to be a part of such action faces each of us. Five years ago the field of hospital standardization as a means to this end was unoccupied. When the College entered the field at that time it did so with exceeding care for it had no precedent

to guide it and it had also to provide itself with the necessary personnel office machinery and financial support to carry the work.

### WHAT HAS THE COLLEGE DONE?

At the beginning of the College in 1913 active work in hospital standardization was accepted by the College as the most practical means to advance the art and science of surgery for if surgery is to be advanced the conditions surrounding the practice of surgery must be correspondingly improved. The following paragraphs state briefly what has been done toward standardization of hospitals since that date.

In 1914 in connection with the necessary work of perfecting the organization of the College and of obtaining a sound financial basis the College began to acquire first hand information about hospital conditions in Canada and the United States. It conferred with doctors hospital trustees and hospital superintendents about the work with medical societies and with hospital organizations asking their help and co-operation in formulating a plan of action.

In October 1916 at the annual meeting of the Fellows in Philadelphia a report of these informal conferences was made. Further at that meeting the Fellows were asked to create in each province in Canada and in each state in the Union a standards committee the purpose of the committees being to advise with regard to a sound and constructive program of action. Promptly after that meeting in accordance with the vote of the Fellows these standards committees were elected by ballot.

For reasons of the war these committees were not called together until October 1917. At that time they were called into session in Chicago about three hundred and thirty being present. About fifty leading hospital superintendents were also on invitation present at the meeting. For two days these committees with their guests considered three fundamental questions which were: What conditions exist in hospitals? What do we want in hospitals? What is to be done? This meeting clarified many hazy problems. A full report of the meeting (Bulletin No. 1 Volume III) was printed and distributed to the hos-

pitals and to the Fellows. The immediate outcome of the meeting was the appointment of a committee of twenty-one upon which were represented physicians surgeons hospital administrators laboratory workers statistician etc. the purpose being to outline a questionnaire through which the College might obtain hospital data essential in its further work and to consider a minimum standard of efficacy.

The committee of twenty-one met for two days in Washington in December 1917, formulated the questionnaire and discussed the minimum standard. Early in 1918 the questionnaire was sent to the hospital together with a letter asking the co-operation of the hospitals in the standardization program. The response of the hospitals to this questionnaire exceeded the most optimistic hope of those concerned with the work. Hundreds of letters came from all parts of the continent pledging co-operation. As a matter of information the questionnaire was sent also to the Fellows. In March 1918 a complete statement of the hospital standardization program of the College and of the minimum standard was sent to the hospitals and to the Fellows. This statement is Bulletin No. 3 Volume III now out of print.

The conferences above referred to all emphasized the need of personal investigations of hospitals. In March 1918 the work of personal investigations of hospital was taken up. The College employed visitors or inspectors to make reports of conditions at the various hospitals. An important part of the work of the visitor was also to explain the details of the program more fully than can be done by pamphlets or letters and to make clear the part of all of the undertaking.

At this time about 700 hospitals have been visited by staff members of the College. The reports of the visitors together with the action taken are recorded upon cards printed for the purpose and are specific as to the following minimum standard:

**STAFF ORGANIZATION.** Extent of analysis of professional work. Regularity of meetings. Regulations contemplated. Evidence of staff teamwork. Group discussion and interest in scientific research. Education of internes etc.

**CASE RECORDS.** Data as to medical surgical and obstetrical case records of all classes of patients.

treated in the hospital methods of recording classifying filing etc contemplated changes

**CLINICAL LABORATORIES** Equipment of the laboratories number and training of the laboratory workers and technicians extent to which adequate laboratory service is provided supervision given internes doing laboratory work

A letter to the superintendent precedes these visits outlining its object and stating the approximate date of visit The visitors of course seek first of all the assistance of the superintendents in this work And before each visit ends the entire standardization program usually finds its way to the local Fellows in ternists staff groups and members of the board of trustees The frankness of all concerned with the hospitals in stating their problems and their willingness to consider these problems with the visitors of the College are a constant encouragement

The following is one of the many reports made for the College by Mr Frank E Chap man this report being in addition to the regular report on the minimum standard

The X Ray equipment is very complete with an exceptionally bright and intelligent technician on duty at all times Volume of work is not large but the character is very good Do not believe it is being used as much as it should be The hospital has a technician in charge of the laboratory Not equipped to do Wassermanns from the conversation I had with the technician I do not think she is equipped to do laboratory work of any kind There is no such thing as routine laboratory work Very little pathology is done and that only when special charges are made

The deplorable thing about the hospital is the general atmosphere of the place It is a business proposition from start to finish Pupil nurses are permitted to do special duty work even in the first year of their training for which the hospital charges and collects the fee This institution is operated in conjunction with two other hospitals of the state all of which are on a par

Again the following somewhat condensed is a report made by Miss Anna C Phillips

**CAPACITY** 150 beds Private charitable institution

**TYPE** Medical surgical obstetrical

**STAFF ORGANIZATION** A loosely organized group Regular meetings not held Any physician in good standing may bring patients to wards or rooms No regulations Number internes three Number pupil nurses seventy two

**LABORATORIES** Well equipped clean light laboratories in charge of part time trained workers Pathological laboratory under staffed and internes

do laboratory work without supervision No laboratory records kept which would indicate volume of work

**SUPPLEMENTARY REPORT** Hospital located in quiet residential section car line near New fire proof building surrounding three sides of large open court gay with flowers shrubs etc The low broad lines balconies facing the court and the general impression of brightness and comfort reflect definite planning and thought Atmosphere dignified and prosperous A sense of confusion in the wards is probably due to the numbers of doctors attending and the varieties of treatments ordered for the same types of cases Staff has been dissatisfied with existing organization but has found difficulty in inducing the trustees to assume responsibility regarding establishment of definite rules and regulations The teaching in the local medical school is not strengthened by the standards existing in this hospital Duplicate report left with chief of staff for presentation to Board

During the current year a full report of the results of these visits will be made by the College and classifications of the hospitals of one hundred beds or over will be published in accordance with the findings of the visitors As stated in Bulletin No 3 Volume III the College will not include any hospital upon an accredited list which permits the practice of the division of fees to exist among the physicians and surgeons caring for patients in the hospital For the convenience of governing boards of hospitals in expressing their policy the following resolution is suggested

WHEREAS the practice known as the division of fees is unworthy and destructive to the best interest of patients and whereas the medical profession is unqualifiedly opposed to this practice in any guise whatever therefore

BE IT RESOLVED that no physician or surgeon who engages in the division of fees may hold the privileges of practice in hospital and further

BE IT RESOLVED that a copy of this resolution be sent to each physician and surgeon who now avails himself of the privileges of practice in hospital and that further practice in the said hospital on the part of these physicians and surgeons be interpreted as acceptance in good faith of the foregoing resolutions

In January 1910 the College published a bulletin Volume IV No 1 entitled Case Records and Their Use This bulletin reviews the program of hospital standardization and explains in much detail what adequate case records are and what their value is in hos



pital service Forty thousand copies of this bulletin have been distributed to doctors hos-  
pital trustees hospital supermtendents etc

In January 1919 the College published also  
a bulletin Volume IV No in which an ac-  
tual set of case record forms was suggested  
The purpose was to prepare record forms  
which are simple convenient and adequate to  
meet the needs of record keeping in cases usu-  
ally found in general hospitals Forty thou-  
sand copies of this bulletin were distributed

In the matter of keeping adequate case rec-  
ords among hospitals the requirements for ad-  
mission to Fellowship in the College have  
proved of practical help Candidates for ad-  
mission to Fellowship are requested to sub-  
mit to the College one hundred case records  
fifty in abstract and fifty in complete detail  
These records if they are to be approved by  
the College must indicate intelligent and thor-  
ough study and treatment of the cases con-  
cerned A hospital in which a candidate for  
Fellowship prepares these records if not al-  
ready keeping adequate records is usually in-  
duced to do so

Early in 1918 as soon as the program of the  
College was made clear requests came from  
hospitals and doctors that the public be in-  
formed of the work Much effort has been  
made to meet this demand In more than  
forty cities hospital standardization confer-  
ences have been held during the past year In  
this way the program of the College has been  
carried not only to the medical profession and  
to hospitals but also to business men's asso-  
ciations chambers of commerce women's  
clubs etc The following program held in  
April 1919 in Portland Oregon is typical

#### PROGRAM

Luncheon *Clubber of Commerce* 1 15 p m

Mr A L Mills Presiding

Fifteen Minute Talk DR JOHN G BOWMAN

Fifteen Minute Talk CHARLES B MOULINIER S J

AFTERNOON SESSION 2 00 O CLOCK

*Lincoln High School*

The Occasion for the Conference

DR KENNETH A J MACKENZIE

Chairman State Committee on Standards

What is Hospital Standardization? (Clinical Lab-  
oratories Case Records Staff Organization)

DR JOHN G BOWMAN Director of College

#### Discussion

- (a) Clinical Laboratories DR A E MACKEY  
MAJOR R L BENSON  
MAJOR R C MATSON  
MAJOR W M S KNOX
- (b) Case Records
- (c) Staff Organization DR S E JOSEPH  
DR E F TUCKER

#### Summary

CHARLES B MOULINIER S J  
President Catholic Hospital Association

Following such meetings many hospital  
take immediate action to meet the minimum  
standard of the College Sometimes a special  
meeting of the local county or city medical  
society is called with the object of bringing  
about hospital standardization for all of the  
hospitals in the vicinity at the same time An  
outgrowth of a number of such meetings has  
been the organization of a central clinical lab-  
oratory to serve all of the hospitals

The co operation of the Catholic Hospital  
Association with the College is encouragement  
The Association officially endorsed the pro-  
gram of the College as its own program and  
through the leadership of Charles B Moulin-  
ier S J President of the Association work-  
ing as a representative of the College the Cath-  
olic hospitals are revolutionizing the character  
of their service to their patients

This comprehensive survey undertaken by  
the College of Surgeons has required for its  
successful execution the expenditure of a con-  
siderable sum of money an average of more  
than fifteen thousand dollars a year More  
than thirty thousand dollars will be required  
for this work during the current year The  
Fellows of the College have provided liberally  
for this and similar work by their dues and by  
the interest on the endowment of five hundred  
thousand dollars subscribed by the Fellows  
A sum of thirty thousand dollars was al-  
so contributed to this special work by the Carnegie  
Corporation

From beginning to end hospital standard-  
ization is the making of a reality out of an  
ideal It is a high spirited clear headed dead  
in earnest effort on the part of all directly con-  
cerned with hospitals to call themselves to  
their own best senses The inspiring fact about  
it today is that nearly all hospital on the con-  
tinent are gladly a part of the effort lowering  
to their own surprise the mortality of their  
own good intentions

# SURGERY, GYNECOLOGY AND OBSTETRICS

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NUMBER 2

## THE RADICAL CURE OF PELVIC DEFORMITY

By HENRY JELLETT MD FRCSI DUBLIN  
M: F: d Hosp: l

I THINK it is time that some attempt should be made to remove a discredit that rests on obstetricians inasmuch as while successful attempts have been made to cure almost every other form of bone deformity by surgical intervention the very serious deformity of contracted pelvis has been left practically unconsidered and uncured. It cannot be said in excuse that it is a condition which does not require cure because both for the sake of the patient her unborn children and the annual birth rate cure if possible is advisable. Further it cannot be said that no surgical cure is available because for certain cases at all events it has been in our hands for years. If an excuse cannot be found a reason or rather several reasons can and they are shortly these. Obstetricians have been divided into two camps in regard to cutting operations on the pelvic bones a minority regard such operations not merely as justifiable but as advisable. A large majority regard them as neither the one nor the other. Further those who believe have their belief narrowed and limited because they have been brought up to regard such operations solely as a means of terminating a particular labor and have altogether or almost altogether passed by the larger view that they can be used as a means of effecting a permanent cure. I think the time has now come both for a little plain speaking on this important subject and for a complete

revision of our views. Plain speaking is necessary to those who would cut out of obstetrical surgery such operations. A revision of views is necessary for those of us who have recognized that the operations have their place therein but have not recognized quite what that place might be. I ask in advance for pardon for two things. First if I am rather dogmatic in this matter I should not be so if the evidence in favor of my views were not so overwhelming and if the opposition to them was not likely to be so strong. Second if I am unwittingly regarding myself as the introducer of views which have already been brought forward by others. Necessity is my excuse for the one fault. Ignorance is my excuse for the other if it exists.

The different cutting operations on the pelvic bones with the object of causing enlargement of the intrapelvic diameters may be reduced for practical purposes to one namely pubiotomy. The nature of this operation and its advantages over others of a similar kind are so well known as not to require description. The general views regarding it held by those who sanction its use may be briefly stated as follows. It is a method of treatment to enable a particular labor to be successfully terminated. It is suitable for the second degree of pelvic contraction i.e. that degree in which the conjugate diameter measures between 8



six children were delivered alive spontaneously and four delivered alive by the forceps in twenty two labors occurring subsequent to the labor at which pubiotomy was performed eleven children were delivered alive spontaneously six delivered alive by the forceps and two by a second pubiotomy. Further that the death of one of the three children born dead was due to placenta prævia and so must not be counted. These figures are very striking in view of the fact that women who have difficult confinements after pubiotomy naturally tend to return to the hospital and so are included in the statistics while women who have no trouble are perhaps usually content to remain at home and so escape observation. Moreover in practice all these cases every effort has been made to promote bony union of the pubic incision and whenever it occurred the full benefit of the operation has not been obtained.

*Pubiotomy is indicated in both the first and second degrees of contracted pelvis.* Up to the present the teaching of those who accept pubiotomy has been that the operation is indicated in the second degree only. In the first degree it is usual either to allow the head to mold through the pelvic canal or to perform prophylactic version. The molding of the head through the pelvis in a case of contraction is as every one knows a tedious process and a most painful one for the patient. It frequently results in the labor ending with the application of the forceps when perhaps the head is still above the pelvic brim and even in failure to deliver by this means. It is then too late to adopt measures other than perforation and indeed in most cases the death of the child has already occurred. Similar difficulties and dangers to both mother and child recur at each subsequent labor and tend to increase in degree after the third or fourth in consequence of the increasing size of the child. Once we abandon the idea that pubiotomy is a means of ending a particular labor and regard it as a means of curing contracted pelvis its adoption in the first degree is even more strongly indicated than in the second because while occasionally it may fail in the lower limits of

the latter degree to cause sufficient permanent increase in size in the pelvis in the first degree it will probably always be successful.

It may be asked how one is to distinguish between the upper limits of the first degree of contraction and a normal pelvis. The answer will be furnished by the histories of the patients concerned. If a woman whose measurements are below normal has difficult and dangerous labors obviously due to pelvic contraction pubiotomy is indicated in order to produce safe and easy labors.

3 *Pubiotomy is not an alternative to caesarean section any more than is the curing of a fractured bone an alternative to amputation of the limb.* Of necessity my observations on this point are in the nature of a repetition. Once it is admitted that pubiotomy is safe and that it produces permanent cure then it takes its place accordingly while caesarean section on the other hand is only a means of effecting the termination of a particular labor. It has its uses for example in an elderly patient who is not likely to become pregnant again it is a more certain method of ensuring the birth of a living child since the ordinary dangers of labor are avoided. If it was a suitable operation to perform late in the second stage I should advise its adoption in primipare who came under treatment too late for an early pubiotomy because I believe almost all the risks associated with the latter operation are due to its late performance. Unfortunately however caesarean section is equally or even more unsuited for such cases on account of the risk of an existing infection of the uterus.

4 *Pubiotomy should never be postponed willingly to the end of the second stage but should ideally be carried out independently of pregnancy when its effects are likely to be required.* So far as my experience goes the two principal causes of injury during or after pubiotomy are first the penetration of the bladder by the pubiotomy needle and second the combined association of the presence of blood beneath the vaginal mucous membrane and a gap in the bony support at the site of incision. Penetration by the needle does not concern us at the moment while the

# Gynecology and Obstetrics

## OF PUBICOTOMY OPERATIONS

			Date of Operation		Operated		Result		Wt Child	Notes				

TABLE I—continued

N	N m	Lab	N t r e f P L b o	P t M		D t f Op t	Op rat	R ft		W t Cl M Lb	N t f S bseq t L b
				C V m	T cm			±	±		
	F M	I		8	9	J ly 95	D Tw dy	A	A	5 36	II Sp t !
	K C	V	ITw d d d IIF p d d IIIP m t 7m IVSp t VIF p d d VIAb t VII Sp o t l			S pt 95	S Wm Smyly	A	A	5	
	E D	VII	N t d d			Dec 95	S Wm Smyly	A	D	9	
3	M G	V	IF p l IIF p d l IIIF r p d d IAP b t my l ( d N 7)	95	5	F b 96	D P f y	A	A	95	VIF r p d t t l s p o d J 99 t
4	J J	I		8 75		J 97	D Tw dy	A	A	6	II F p l
5	M K	I		9		J ly 97	D P f y	A	D	7 1/2	
6	L B	I		8 8		J 98	D J l t t	A	A	6 1/2	
7	M K	I		8		Ap I 98	D J l t t	A	A	7 1/2	
8	M O	II	I Ab rt	8 5		Aprl 98	D J l t t	A	A	6 6	
9	L D	I		8	5	J 98	D J l t t	A	D	7	
3	M C	I		9	5	J ly 98	D J l t t	D	A	5 1/2	
3	C D	I		8 6		J ly 98	D J l t t	A	A	6 1/2	
3	M O T	IV	IF p d d IIF p d d IIIF p d d IIP b t my l ( d N 7) V T d d p d l d d J 0.3 VI F p l VII I p d d VIII B h l	7		S pt 98	D J l t t	A	A	7 1/2	
33	S W	I		7 7	3 7	J 99	D J l t t	A	D	9 1/2	
34	S H	II	I F p d d	8 4	8	J 99	D J l t t	A	A	7 1/2	
35	M M T	V	ISp t d d II T d i III Cæ t I Cæ t I	7 5	5	J 99	D J l t t	A	A	6 1/2	

D d m tes II y d o c p h l d p b f id  
II y d o c p h l

other causes do. There is always bound to be a certain amount of hæmorrhage at the moment of operation as a result of small injuries to the vulvar venous plexus. This blood cannot readily escape and consequently tends to dissect a space for itself between the bone and the mucous membrane and there to form a hæmatoma. Further at the point of separation of the ends of the bone there is a gap which leaves the vaginal walls

unsupported. As a result when the vagina is forced to dilate by the descending head it tends to tear where it is unsupported and this tearing is made more extensive by the hæmatoma behind it. Such an accident is most prone to occur when delivery is effected in primiparæ by the forceps immediately after the pubiotomy. It is less likely to occur if delivery is spontaneous and still less likely to occur if the operation has preceded

TABLE I—STATISTICS OF 35 PUBIOTOMY OPERATIONS

N	N m	L b	P l M	D t I	O	R	It	Chld	N t	l	bseq	Lab
	C S	I B h d d II B h d d III M sc IV B h d b	7		M h 7	I T dy	A	D	6			VI po eo l 84 pou d VII po eo h 7) pound M 9 I po ry l z M h
	I C	III d f i d i l	5		I y	D T d	A	A	84			
	E H	I		5	M y	D T dy	A	A	73			II Sp t eo l po d M y 9
	I	I F l i d II l i b d l III po d IV l i d h			J 7	D Tw d	A	A				
	M I	III d h y my	8	8	I	D T dy	A	A	61			
	R N	I	8 3	4	N 9	D Tw dy	A	A	8			II Sp eo al 84 po d J y 9
	M O I	IV I F s d d II I po d d III I p l d			O	D T dy	A	A	74			V T rs pod l VI d 6 po d j s VII p d d VIII ech l IX P b i my al ( d N s)
8	M C	III I C m my	8 3	3	N	D T dy	A	A	7			IV Sp po d M ech 9
	M K	II			N	D J l l	A	A	6			
	M B	IV I I po I III po l	7		M h	D J l l	A	A	6			V I re p l J
	K B	I		5	M h	D J l l t	A	A	6			II P l p v h dra M h rs d d 6 y p d
	M W	II			J	D J l l t	A	A				
	C O C	I	7	3	A 9	D J l l t	A	A	73			II Sp t eo l III po l IV F p l V Sp eo l
	M R	III	8 5		Ap l 3	D J l l t	A	A	55			
5	R M	II I po t p m	4		Ap l 9 3	D J l l t	A	A	83			
6	R S	IV I F ps l II I w l d III w m t IV B w l p I d	9		A 9 3	D J l l t	A	A	93			
7	M G	IV I F p l d II F p d d III F p d d			N 9 3	D J l l t	A	A	7			V F b my l e f d F b o (end) ertu V I F ps d I 84 po d J 9
8	M C	V I F p I d d y II F re p l d f w III C m t IV C my	8	5	Ap l 9	D J l l t	A	A				
	A R	I	8		A	D J l l t	D	A	61			

temporary increase in the pelvic diameters during labor. In this case again if a more extended experience shows that a sufficient increase in the pelvic diameters is not to be obtained in this way it is possible that a bone grafting operation might give good results. For the moment however as I have said above results appear to indicate that such a step is unnecessary.

The difficulties in the way of adopting such procedures as either excision of a piece of bone or bone grafting is not to be found in their inherent risks which only occur once in the woman's life and which must be far less than the risks of repeated cesarean sections. They rather lie in the direction of determining whether the operation will be subsequently needed or not. My point however is that if the patient wishes to have and is likely to have further pregnancies even a bone grafting operation is a preferable procedure once it is proved to be necessary to repeated cesarean sections.

It is also possible that both bony and fibrous union might be avoided by exposing the line of incision and bringing a piece of the pubic fat between the bones. On these points however I do not want to express a definite opinion first because I do not know that any of them is necessary and second because I only want to insist on facts which I regard as established.

The foregoing five points constitute the main argument of this paper but I should like to supplement them by a few words on certain alterations in the usual technique of the operation.

The first point on which I must insist is the necessity for accurate measurement of the internal diameters of the pelvis and the exclusion of such degrees or types of contraction as we cannot hope to overcome by division of the pubic bone. It is extraordinary that at the present day there are still so many obstetricians possessing the highest skill and knowledge who consider they can not measure a pelvis with Skutsch's pelvimeter or who think that its use is unnecessary. I am aware that great advances have been made in surgery by means of X-ray photographs and such results are probably quite

satisfactory if obtained by a roentgenologist accustomed to make them. The clinical difficulties in the way of the general extension of the practice are however very great. The ordinary error of a man accustomed to the use of the Skutsch instrument ought to be something less than 0.3 centimeters and this gives sufficiently good working results. The necessity for accurate measurement lies in the necessity for excluding from operation cases in which the pelvis is too small to allow the subsequent delivery of the foetus alive and in good condition without injury to the mother. The lowest limit is I think rightly put at 7 centimeters in the case of a flat pelvis and 4.5 centimeters in the case of a generally contracted pelvis. The first case on which pubiotomy was performed in the Rotunda Hospital is an example of the results of operating below this limit. In this patient the conjugate measured 6.5 centimeters. The child it is true was delivered alive but of her four subsequent labors one ended in craniotomy and three in cesarean sections. I have excluded this case from my statistics because it does not fulfill the conditions laid down. We have no record in the hospital of any similar case so far as subsequent labors were concerned.

I do not propose to enter into a description of the operation itself as it is too well known. There are just a couple of points to which I must refer. I do not like Bumm's sharp pubiotomy needle because its point if pressed against the bone tends to stick in the latter and if allowed to leave the bone tends to wander into the bladder. I use a blunt Döderlein needle the elbow of which I have straightened so that it is no longer right angled but carries its curve in the continuation of the handle as in the case of Bumm's needle. This necessitates making a nick in the skin to allow its entrance and another for its exit.

I think it is a matter for further consideration as to whether the subcutaneous method is advisable when the operation is performed under the most favorable circumstances. When the operation is done at the end of labor just prior to delivery the subcutaneous method undoubtedly possessed advantages



labor by some days or weeks. In other words the more complete the recovery of the soft parts from the trauma of the operation the less likely is laceration to occur and the smaller will be its effects if it should occur. This suggests that the ideal time at which to perform pubiotomy is when the patient is not pregnant because then the uterine blood supply will be at its smallest. Indeed the only objection that can be raised to such a practice is that the patient might never require the effects of the operation that is she might never again become pregnant. When however future pregnancies are fairly certain to occur I should advise operation independently of them. Further I think it is a matter for consideration as to whether when in a primipara the existence of contraction is not recognized until the patient is in or very near labor we should not deliver her by cesarean section and perform pubiotomy at a subsequent date for the benefit of future labors.

5 *Every effort should be made to prevent bony union of the cut surfaces.* I think I am right in saying that when pubiotomy was introduced one great advantage it was said to possess over symphysiotomy was that bony union of the cut surface usually followed. This was believed to be an advantage because it was supposed that without such union the pelvic girdle would be impaired and there would be interference with the power of walking. Such a supposition is of course untenable as is amply proved by cases in which the piece of bone between the saw cut and the symphysis has come away without harm to the patient and by the ambulatory powers of women who have been born with a split pelvis. On the other hand the occurrence of bony union prevents any considerable permanent increase in the size of the pelvis and prevents any separation of the bones during labor. It can best be avoided by refraining from the prolonged use of the pubiotomy belt by allowing patients early movement and by getting them out of bed as soon as possible after operation.

The following history is an interesting example of the importance of this point

Mrs M G (Case No 17) pelvis measuring 9.3 centimeters in the conjugate and 20.5 centimeters in the transverse had pubiotomy performed by me in November 1913 a living child being delivered. According to the practice of that date she was kept very quiet after the operation with the result that bony union took place at the incision. She returned to the hospital in February 1916 and in consequence of the failure of the healing of the incision I urethrotomy had to perform a second pubiotomy on the opposite side a living child being extracted by the forceps. She came into hospital again in January 1919 on the condition then being that my incision was united by bony union and the incision left by Dr Lureloy by fibrous union as diagnosed at the time and proved by a subsequent roentgenogram. The membranes had ruptured before admission and the patient had very poor uterine contraction. She was given every opportunity to deliver herself but this failing owing to the weak contractions I had to apply the forceps and delivered a living child without the smallest difficulty.

I think this case conclusively proves the advantage of a non rigid union of the bones.

It may be asked if it is possible to guarantee a non bony union by the means I have suggested and the answer will be that it is not possible to do so but that such union is most likely to result if we deliberately try to produce it. If on the other hand further experience goes to show that bony union does result in some cases in spite of every effort to prevent it then there will be a legitimate reason for adopting some method which will positively prevent it. Such a method might be found in the removal of the fragment of bone between the saw cut and the symphysis a procedure which does not seem to give rise to any inconvenient consequences. For the moment however results appear to indicate that such a step is unnecessary. Once it is shown to be necessary I do not see that we need have any hesitation in adopting it.

It may further be asked whether even if non bony union results its fibers will stretch sufficiently to allow increase in size of the pelvis at subsequent labors. Here I think we are on surer ground. So far as my own experience goes at any rate delivery occurs without difficulty. The explanation is probably to be found in the softening and general relaxation which is known to occur in the fibrous ligaments of the pelvis toward the end of pregnancy and which permits a slight

temporary increase in the pelvic diameters during labor. In this case again if a more extended experience shows that a sufficient increase in the pelvic diameters is not to be obtained in this way it is possible that a bone grafting operation might give good results. For the moment however as I have said above results appear to indicate that such a step is unnecessary.

The difficulties in the way of adopting such procedures as either excision of a piece of bone or bone grafting is not to be found in their inherent risks which only occur once in the woman's life and which must be far less than the risks of repeated cesarean sections. They rather lie in the direction of determining whether the operation will be subsequently needed or not. My point however is that if the patient wishes to have and is likely to have further pregnancies even a bone grafting operation is a preferable procedure once it is proved to be necessary to repeated cesarean sections.

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I think it is a matter for further consideration as to whether the subcutaneous method is advisable when the operation is performed under the most favorable circumstances. When the operation is done at the end of labor just prior to delivery the subcutaneous method undoubtedly possessed advantages

On the other hand I am inclined to think that in operations done at the time of election it will be found wise to make a small incision above the pubis to separate the bladder from the back of the pubic bone in the region of the saw cut and to pass the needle from above downward. I think this is a more surgical performance and therefore likely to be adopted.

If the subcutaneous method is adopted the condition of the inside of the bladder must always be examined. This should be done as soon as the needle has been passed and before the saw is pulled into place with the object of excluding positively the entrance of the needle into the bladder. My own practice is to pass a catheter as soon as the needle has been introduced. If any drops of urine in the bladder are clear it is a sign that all is well. If on the other hand there are any drops of blood then a little fluid should be injected into the bladder and the anterior wall carefully examined with the catheter in order to detect by sound and touch whether the needle has really entered or not. The presence of a little blood in the urine does not necessarily mean penetration of the bladder wall.

If penetration does occur then the operation must be abandoned for the time being if it is possible to do so and when next attempted should be done by the open method at the opposite side. If its immediate performance is essential as in the case of a patient well advanced in the second stage the same course must be adopted. On no account is it permissible to pull the saw into position by a needle which has penetrated the bladder as subsequently the included bit of bladder wall would be cut through by the saw and a large opening result. On the other hand a mere puncture is probably of little import unless if care is taken to empty the bladder at short intervals during the next week.

The only objection that can be legitimately urged against pubiotomy is the slight uncertainty that exists as to the exact position of the needle point at the moment it is passing over the upper margin of the pubis. This uncertainty added to the slight variation that may exist in the exact relation of the anterior wall of the bladder to the same region may

result in perforation of the bladder wall. It is for this reason that I so strongly urge the performance of the operation as long before labor as possible because then all uncertainty can be removed by performing the operation by the open method.

At the present time it is very difficult to get an opportunity of examining patients suffering from deformity previous to labor because neither the patient herself nor the general practitioner who knows of her case appreciates the importance of an early diagnosis. This however is only a matter of education and once its importance is recognized then women in whom deformity is suspected will come under treatment in good time. The object of this paper is to remove the false impressions that surround the operation and any intrinsic uncertainties that attach themselves to its performance. Hence I strongly urge on medical men the necessity for early diagnosis in order that early treatment may follow.

I may say a word to emphasize the importance of using sharp saws. Operators of non-mechanical tendencies are apt to think that because the instrument once was a saw it remains so indefinitely. This is a fallacy which leads to a lengthy forcing of the saw through the bone with attendant sawing of the skin and soft part.

The after treatment of the case is of much importance. Bony union being not only unnecessary but detrimental must be avoided. At the same time the necessary approximation of the bones must be ensured. I am inclined to think that even if no particular care is taken this approximation will occur spontaneously. It is however well to apply a pubiotomy belt as soon as the operation is done and to have the belt in place during labor to avoid undue separation of the bones. On the other hand it must not be too tight to allow the correct amount of separation. It may be taken off as soon as the bones tend to remain in fairly close apposition of their own accord and this will be probably about the fourth or fifth day. Any movements of the patient which do not cause pain may be allowed. There should be little or no tenderness in the region of the incision and its

occurrence usually shows that some infection has occurred. The patient may leave her bed if convalescence has been normal any time after the tenth day when there should be no impairment of walking power other than a slight stiffness which soon passes off.

### CONCLUSIONS

In conclusion I should like to suggest that there are certain points in regard to pubiotomy which we must consider to be proved and which may be summarized as follows:

1. Pubiotomy is a safe operation.

It both enables a particular labor to be terminated satisfactorily and it cures certain degrees and types of contracted pelvis.

3. It should be performed as long before the delivery of the patient as possible.

4. Bony union of the cut surfaces is unnecessary and disadvantageous.

On the other hand there are certain points which are still to be decided and among them I may mention three:

Should pubiotomy be performed independently of pregnancy and labor?

Should it be done by the open method?

Should any special steps be taken to prevent bony union?

*Prima facie* it would appear as if the first two questions at all events should be answered in the affirmative and that by so doing we shall prevent complications.

It seems to me that it will require some very powerful not arguments but facts to disprove the statements I have made in the foregoing paper and the consequences I have deduced from them. They will certainly not be disproved by the old fable of the number of crippled women who have been seen after pubiotomy because I do not think anyone quite believes in them any longer. Nor can that very heavy obstetrical stumbling block serve as an obstruction—that the operation is unsuitable for performance by the general practitioner. Of course it is unsuitable if for no better reason than that the only cases in which he is likely to be called on to perform it are those in which immediate delivery is necessary and in which consequently it is most likely to be difficult and complicated. But surely

TABLE II—NATURE OF PREVIOUS LABORS

Nature of Labor	Number	Result	Child
		Alive	Dead
Spontaneous	12	6	6
Induction	2	1	1
Forceps	21	4	1
Version			2
Craniotomy	4		4
Symphiotomy	1		1
Unclassed	3		3
Total	45	11	34
Twelfth month			

TABLE III—NATURE OF PUBIOTOMY LABOR

Number	Cause
Mothers alive	35
Mothers dead	33
Children alive	2
Children dead	31
Causes of maternal deaths	5
Collapse due to fatty degeneration of the heart	1
Acute military tuberculosis	1
Causes of fetal deaths	
Prolonged labor	3
Second of twins	1
Hydrocephalus	1

TABLE IV—NATURE OF SUBSEQUENT LABORS

Nature of Labor	Number	Result	Child
		Alive	Dead
Spontaneous	1	11	
Forceps	7	6	
Version			
Pubiotomy			
Total	22	9	3
Obstetrical			

obstetrical specialists must be very hard set for an objection if they have to resort to one of this type.

The part to be played by the general practitioner in regard to pubiotomy is of considerable importance. It consists in sending patients in whom he suspects the existence of contracted pelvis for accurate diagnosis and surgical treatment at as early a period in pregnancy as possible or even before pregnancy occurs and not as is so often the case at present after the patient has come into labor.

I said at the beginning that plain speaking was necessary and now I make no apology for my last sentence. The operating obstetrician and gynecologist of today has no right to allow himself to be prejudiced by the unproved criticisms and traditions of others in regard to an operation which offers so much benefit to the great majority of women suffering from contracted pelvis.

## A FEW OF THE FACTORS THAT ENTER INTO THE SURGERY OF THE PROSTATE<sup>1</sup>

By JOHN B. DEWEY, M.D., F.A.C.S., PHILADELPHIA

THE bearer of an enlarged prostate or the prostatic as he is often laconically termed is at times one of the perplexing problems of the surgeon. We have generally to deal with a patient presenting many of the disadvantages of advancing years which of themselves may contraindicate operative interference. On the other hand such good results follow prostatectomy that we are often tempted to take the off chance. It would of course be folly to treat every instance of prostatic hypertrophy with prostatectomy. In some cases it would be entirely too drastic a procedure compared to the clinical symptoms while in others it would only mean making a bad condition worse.

The surgeon naturally rarely sees that class of cases in which the urinary disturbances are limited to frequency, usually nocturnal and painful tenesmus of the sphincter muscle with interrupted or sluggish urination. These cases very often yield to treatment dietetic—non irritating foods or local in the shape of massage, baths, etc.

It is when this treatment fails that retention begins and the patient seeks surgical relief. When he finally comes under our care there are several important points to be considered before deciding the question of operation. First among these is of course the condition of the patient's heart, blood vessels and his general condition. Then the careful examination of the prostate first by rectum and then with the aid of the cystoscope. But before making the cystoscopic examination the patient should have been resting in bed for at least twenty-four hours and have been receiving medication in the shape of urotropin and quinine. The cystoscope will often give definite information as to the nature of the disease or the enlargement, whether it be benign or malignant, it reveals the condition of the bladder, the presence of a foreign

body, the condition of the urethra and of the kidneys, permits estimation of the amount of residual urine and often determines the operability of a given case. It is well before introducing the cystoscope and certainly after cystoscopy to place for a short time a soft rubber in dwelling catheter, the length of time for its retention depending on the amount and the character of the urine that is passed. The value of the in dwelling catheter whether or not in the presence of kidney insufficiency or any other kidney condition resulting from or accompanying the prostatic enlargement surely admits of no argument.

A not infrequent accompaniment of prostatic enlargement is vesical calculus generally considered to be the result of residual urine but which may also be its cause owing to the irritation to the bladder and consequent vesical as well as prostatic congestion. Removal of the stone relieves the constriction and sometimes also the urinary obstruction by reduction of the prostatic enlargement. But when the enlargement of the bladder is not a temporary one the question of removing the prostate at the same time as the stone is a matter of judgment on the part of the surgeon, much depending on the general condition of the patient, the presence or absence of infection.

The continued presence of residual urine throws an added strain on the bladder muscle, the walls of which in time hypertrophy and unless the obstruction is relieved we have that dread condition atony of the bladder with its train of possibilities which you are all familiar with—chronic retention, dilatation of the bladder or fibrous contraction with the formation of trabeculae and false diverticula that form convenient sites for urinary collection and possibly stone formation. The muscular paralysis can often be somewhat relieved by active attempts at evacuation and mechanical pressure.

The overdistended bladder should be relieved before any attempt is made to deal with the prostate or even to do a cystoscopy. The nervous and cardiovascular system of the average prostate are very easily deranged and every effort should be made to exclude all factors that might encourage such derangement. In fact I deem it inadvisable to relieve an overdistended bladder at once with the catheter but prefer to reduce the amount of residual gradually day by day until the bladder is finally allowed to remain empty by the permanent indwelling catheter. The cystoscope in this class of cases should be used with caution especially in pronounced enlargement with considerable residual urine a condition in which injury is easily inflicted.

Another question that determines the operability or inoperability of a given case is carcinoma. Carcinoma of the prostate does not produce urinary obstruction until the carcinoma is well advanced since it usually develops in a non hypertrophic portion of the gland and nearly always in the posterior part of one of the lateral lobes. The cancerous process remains within the confines of the prostatic tissue for a long time before it invades the neighboring tissues. The obstruction is generally due to enlargement of the median and the anterior portion of the lateral lobes for in about 50 per cent of the cases carcinoma and hypertrophy of the gland are associated although in their early stages both processes are separate and distinct (Judd). When the enlargement is such as to cause obstruction the patient will probably seek relief before the carcinomatous condition has advanced too far to preclude operation. In a few favorable conditions complete enucleation of the gland may be attempted but as a rule the only surgery if any that can be offered is palliative relief in the shape of partial prostatectomy. Radium treatment has its advocates but I am not one of them. I have seen few if any favorable results therefrom.

The differentiation between benign hypertrophy and carcinoma is often possible by means of cystoscopy and also by urethroscopic examination. With the latter as demonstrated by Braasch there is visible a

distinct sulcus between the lateral lobes in cases of hypertrophy while with carcinoma instead of the depression there is seen a median elevation in the floor of the urethra and a longitudinal narrowing of the lumen the urethra also appears corroded and bleeds easily when the urethroscope is introduced.

No surgeon is going to run the risk of operating upon a prostate before determining the functional capacity of the kidney. And as you well know in the color elimination test and the estimation of the urea of the blood and the urine we have the most reliable and accurate tests that the modern laboratory furnishes us. I have used these tests in hundreds of surgical cases of every description and I have no hesitation in acclaiming their value. Any question of their reliability I confess neither impresses me nor influences me against their continued use. But I am only repeating my constant contention when I say that even with such reliable laboratory aids we cannot afford to ignore the valuable information derived from the clinical history and the physical examination of the patient himself. Nearly all if not all instances of enlarged prostate demand drainage of the bladder. Very often the relief afforded leads to such satisfactory general improvement that operation can be undertaken even though the functional test and the specific gravity of the urine are low and vice versa without such general improvement operation is often inadvisable in spite of the satisfactory results of the laboratory tests. This is of course subject to limitations. You all no doubt are daily confronted with instances in which for some reason or other the general condition fails to improve then the kidney functional test is the only guide in deciding for or against operation. Sometimes this failure to improve is due to infection from the residual urine a condition which adds greatly to the risk of prostatectomy. It is important to increase resistance to infection by suitable measures the most valuable of which is prolonged bladder drainage. The urine should be studied bacteriologically. If as is often the case the colon bacillus is grown in culture the question of an autogenous vaccine as recommended and practiced by

Judd to increase the patient's resistance should be considered

In every operative case there are three stages—before during and after the operation. Of these the first is the most important. The third stage getting the patient well is the next in importance while the second or operative stage is the least important of the three. In this I believe every experienced surgeon will concur.

Having earned the patient satisfactorily through the first stage the next question is the choice of operation. To my mind for the great majority of enlarged prostates there is but one operation the suprapubic. The infrapubic operation is first of all safe only in the hands of the master operator and if indicated at all it is in the presence of a comparatively fibrous and in the carcinomatous prostate and in either instance only when the patient is of comparatively lean build. For this type the Young operation is to be preferred since it enables the operator to see well what he is doing and thus to do well what he sees to be done.

To discuss the superiority of the suprapubic over the infrapubic would not only be out of place before a society of genito-urinary surgeons but it would occupy time which I hope to use to better advantage. The advantages of the suprapubic method of removal of the prostate can be expressed by the statement that sight gives in sight. Every nook and corner as it were of the bladder cavity can be surveyed as well as palpated to a certainty which cannot be done by the infrapubic operation. It may be argued that this is the purpose of the cystoscope. Well and good but the cystoscope does not give the same degree of certainty as the naked eye. Seeing the interior of the bladder noting the color of the mucosa and its character observing the site of macroscopic foci of infection if present whether the mucous membrane is softened and bleeds easily—all of these are guides in determining whether or not it is best to do a two stage operation. This I regard as one of the most important if not the most important question in the surgery of the enlarged prostate and on the decision often depends the successful issue of the case.

In taking a stand in favor of a two stage operation I am aware I am doing so in opposition to some of our very best surgeons but nevertheless to my mind this does not affect the soundness of my position. The two stage operation together with the careful pre-operative treatment of the patient contributes greatly to the low mortality of the operation of prostatectomy.

The two greatest dangers presented by the operation are uræmia and hæmorrhage. The former still figures but inconspicuously so if the case has been carefully studied as I have outlined. In this connection before going further let me say that a patient even though functional tests are good heart and blood vessels in fair condition as far as can be determined blood pressure and sphygmographic tracings being by no means infallible even if there is no history of shortness of breath or attacks of dyspnoea cardiac cough or dizziness and the bladder even on inspection appears perfectly satisfactory is not a case for immediate removal of the gland if he has been passing huge quantities of lumped urine with low specific gravity. It has been my experience that this is the type of case likely to develop a uræmia of the chronic variety. If the two stage operation is performed under the circumstances uræmia although it occasionally does is much less likely to occur.

In doing either the two stage or the complete operation at one sitting I have yet to see a prevesical abscess result provided the vesical fatty tissue is incised and not scraped aside with the tip of the finger or with the end of the handle of the scalpel bleeding being arrested by ligature and the prevesical space drained by rubber dam.

In controlling the bleeding no pieces of the gland should be left in or else the prostatic bed will not contract sufficiently to minimize the chance of bleeding. The principle is the same as in the bleeding from the uterus following abortion where particles of placenta are retained.

I have seen but one patient perish from hæmorrhage this followed a suprapubic removal and could have been prevented had the gravity of the bleeding been recognized and the surgeon reached the patient in time.

When in doubt as to the extent of the bleeding the only safe course to pursue is to pass a suture around the bladder margin of the prostatic bed much in the manner of a purse string then a small gauze pack the free end of which is brought out of the wound along side of the tube is placed in the bed and the suture tightened This absolutely controls the bleeding

I and doubtless many others have had narrow escapes from having patients bleed to death by failure to pack the prostatic bed at the time of the operation in the hope that the bleeding would cease spontaneously I have taken this chance because having the patient in the hospital and being within call I could act promptly in the event of any untoward occurrence Upon two occasions I have had to re open the bladder wound clean out the blood clots and pack the bed both patients making a smooth recovery

As to the choice of anesthetics nitrous oxide and oxygen anesthesia suffices in many cases and generally for the first stage of the operation and has no deleterious effect upon the kidneys I grant that for the secondary operation it is not so desirable since the abdominal walls are not relaxed as in ether anesthesia yet this is not of great moment unless the enucleation be a difficult one due to peri prostatic adhesions etc On general principles nitrous oxide anesthesia is contra indicated where the blood pressure is very high though I occasionally give it in such conditions In most such cases chloroform or intraspinal novaine anesthesia is more useful But ether is the safest and in the average case is the anesthetic of choice

Local anesthesia I have no experience with my time being too much occupied by numerous operations to permit wasting any of it in practicing this form of anesthesia

In the after care of patients the watch word is of course kidney function I do not permit my patients to get out of bed as early as do some surgeons although the practice may be a good one I believe in slowly increasing the general regime and diet

When a two stage operation is chosen before the second stage or the enucleation is resorted to the functional tests should be made as before any operation thus adding to the safety of the procedure

As to sequelæ fistula does occasionally form after the suprapubic operation but in my experience it has always been temporary When it does occur shortly after the suprapubic wound has healed it can be corrected by the passage of bougies Stricture may follow either the suprapubic or the infrapubic operation I have seen it in a few cases

Permanent incontinence I have not seen following the suprapubic but have seen it after the infrapubic operation I have also seen permanent fistula follow the low operation

Epididymitis phlebitis parotitis acute cardiac dilatation and pulmonary embolism are known to have occurred

Points I have not seen mentioned are the shrinking of the gland that occurs after the first stage in a not inconsiderable number of cases and also that the bleeding after the removal of the prostate in a two stage operation is not so profuse as after the one stage operation



## INFECTIVE ( SECONDARY ) HÆMORRHAGES FROM WAR WOUNDS

## A CLINICAL AND PATHOLOGICAL STUDY

BY CAPTAIN HAROLD NEUFHOT M C U S A AND CAPTAIN FORDYCE B ST JOHN M C U S A  
U S B e H pital N e W ( l e b y U S A ) C n l H o pital B E F

**I**N the accessible literature we find that the subject of secondary hæmorrhages is briefly treated conflicting views are expressed and very little evidence is advanced to support the various statements that are made. Exhaustive articles upon the complication of war wound barely mention the condition. Some writers hold that secondary hæmorrhage should never occur if wound are treated adequately primarily maintaining that the injured vessel will have been found and adequately cured for. Secondary hæmorrhage is believed by other authors to be due to infection added to the primary injury of vessels. A third group assigns an insignificant role to the original injury believing infection to be the essential cause. The treatment of secondary hæmorrhage is usually dismissed either with the statement that the vessel should be ligated in the wound at the site of the lesion or that it should be ligated proximally to the wound. We have been unable to find any description of the pathology of secondary hæmorrhage in war wounds (or in civil practice). The following analysis of the material seen in our hospital during the past year is presented because we have found secondary hæmorrhage to be a serious complication one of the first importance in war wounds.

The reason for adopting the term infective hæmorrhage should be explained at the outset. Secondary hæmorrhage is a rather loosely used expression to describe all but primary hæmorrhages it is secondary or consecutive to a variety of causes. As will be shown our study demonstrates that infection was the sole cause of the hæmorrhages ordinarily classified as secondary. Infective hæmorrhage is a term that particularizes this class of cases and will therefore be employed.

Infective hæmorrhage occurred in 45 patients of a total of about 5000 surgical cases

that passed through the hospital in one year (1 per cent). Many of these cases were minor ones others did not require surgical intervention. Its incidence is therefore better appreciated in the statement that 6% of a total of 332 operations were undertaken for its control (9 per cent). The occurrence of infective hæmorrhages varied considerably with the different convays of wounded but was in general proportionate to the frequency of infection. We gained the impression that it became less common with the wider operative exposures that were more and more frequently practiced. An inspection of the report of our cases shows that infective hæmorrhages occurred most often if more conservative or no operative procedures were employed in the treatment of the wound.

The onset of infective hæmorrhage ranged from 5 to 47 days after the time the wound was inflicted the average period for the first appearance of blood being 18 days. We are first because in none of our cases was there any evidence that previous delayed hæmorrhages had occurred. It is difficult to state when the danger of infective hæmorrhage exists. In one of our cases for example (Case 5) a hæmorrhage occurred 2 weeks after the wound was received. Many of our patients were under observation for very limited periods. From the study of our material all that can be said is that the danger of infective hæmorrhage is over only when infection has ceased.

By referring to the report of cases it will be noted that recurrence of infective hæmorrhages of slighter degrees was not at all uncommon. This question is of much clinical importance. One sees that slighter hæmorrhages were usually treated conservatively operations aimed to discover the cause of and to control the bleeding being performed only after the hæmorrhages had recurred once or oftener. That the lesion then di-

closed was usually a defect of the main artery in the region of the wound and that the hæmorrhages were slight only because of thrombotic obturation will be subsequently indicated. The fact we wish to emphasize here is that a slight degree of hæmorrhage is absolutely no guide to the size of the vessel involved or to the extent of the lesion.

The wounds the source of infective hæmorrhage varied greatly in size and depth many being complicated by fractures. The depth was appreciable in all except the few superficial ones in which the bleeding clearly came from granulation tissue. Major arterial trunks were in most instances in the neighborhood of the wound. Not a single wound in our series was in a clinically satisfactory condition or approached bacterial sterility either at the time of admission to the hospital or when the infective hæmorrhage occurred. In those that appeared to be only slightly infected over their visible surface the first operative exposure or the operation for the infective hæmorrhage disclosed more extensive infection in the depths.

In short infection was present in every case although to very varying degrees. When widespread it was of course impossible to determine a greater or less involvement in the region of the vessel from which the bleeding arose. On the other hand operative dissection of the vessels in less infected cases not infrequently revealed the maximal visible extension of the infection along their sheaths. If not maximal the extension in this direction could nevertheless always be determined.

The infected tract led to and a short distance (generally to 3 centimeters) beyond the rupture in the artery. The latter was sometimes adjacent to the wound or amputation stump but more often some distance central to it. This distance varied from a centimeter or so up to 6 centimeters. The remoteness of the site of rupture from the wound is one of the reasons we have for believing in the non traumatic nature of secondary hæmorrhage and we therefore wish to emphasize it accordingly. In all the specimens of arteries resected for infective hæmorrhage the rupture was an oval or elliptical defect lying in the long axis of the

vessel. The maximal transverse loss of substance was usually about one third the circumference of the artery in only a few instances was it much greater. The margin of the defect was often smooth and rounded off shaggy and irregular in some cases. A thrombus occupying a varying part of the lumen was occasionally observed. No reference has been made to infective hæmorrhages from vein lesions for we have neither seen specimens of such lesions nor are there any proved cases of vein hæmorrhages in our series. Up to the present time infective thrombosis of the vein or veins accompanying the diseased artery has been noted at operation in only a few cases yet it is a most important part of the picture of infective hæmorrhage. This question of involvement of the vein will shortly be discussed.

The following observations on the pathology of the arterial lesions are based upon examinations of 14 specimens removed at operation or from limbs amputated for hæmorrhage and infection<sup>1</sup>. There are considerable variations in the microscopic pictures but a general conformation to a well defined type. The artery is embedded in infected granulation tissue its adventitia showing a varying degree of round and polynuclear cell invasion. Edema of the muscularis so marked as to be readily confused with hyaline degeneration is common otherwise the muscular coat is usually normal everywhere down to the immediate vicinity of the rupture. In cross sections through the latter a varying but usually small number of leucocytes is found scattered in the muscularis in one instance this coat contained a small abscess at a point opposite the rupture. In only one case was the muscular coat entirely destroyed at the level of rupture having been replaced by partly organized granulation tissue. As the defect is approached the muscle bundles show degeneration merging into complete and massive necrosis.

It is only here that intense leucocytic invasion of the muscularis is usually seen. The internal elastic is split into numerous narrowed strands in the zone of degenerated muscularis.

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G d g m t t a l f ba t u w r e m p l y d

ris Round cell infiltration and reduplication of the intima are seen at the level of rupture being most marked in its neighborhood. The intima is often spread like a sheet over the abrupt termination of the media. The open lumen of the vessel either U or V shaped frequently contains a thrombus of varying size always infected and of fairly or very recent origin in the great majority of instances. In only one case (Case 16) was the thrombus partly organized of appreciable extent (about 2 centimeters) beyond the defect and with definite evidence of attempt at repair. The picture was that of a small dissecting aneurism. It is of interest to note in the history of this case that the bleeding ceased without operative intervention and did not recur the patient dying of other causes. From the examination of our material we believe that the pathological condition preceding open rupture is in all probability this type of small dissecting false aneurism.

Bacterial stains of the arterial sections show various types of organisms ranging from very small streptococci to large thick rods. In some specimens the bacteria are very few in number in others very numerous and grouped in clumps. They are usually distributed in a rather characteristic fashion being chiefly found in the peripheral zone of the thrombus at and in the intima in the necrotic portion of the muscularis and in the adventitia. The striking feature is the total or almost total absence of bacteria in the muscularis except at the site of rupture. Very few organisms are seen anywhere in the vessel wall within a few millimeters of the rupture even when numerous in its immediate neighborhood beyond this level they are usually no longer to be found except in the thrombus.

Except in the fatal cases there have been very few opportunities to study the vein or veins accompanying the diseased artery. In every instance in which this has been possible however the veins have shown pathological alterations ranging from phlebitis with infected thrombus to suppurative thrombosis accompanying extensive involvement of the vessel wall. Thrombi and veins both contain bacteria generally in larger numbers than in the associated arterial lesions. The post

mortem examination of patients who have had secondary hemorrhages have invariably shown the presence of infection. This has been systemic in the great majority of cases with various pyemic foci the source of distribution being a suppurative thrombosis of the infected venous trunk accompanying the diseased artery. The entire question of vein involvement in infected war wounds is being studied in the hospital laboratory at the present time. In this place we only wish to point out the frequent association of oftentimes fatal vein infection in cases of infective hemorrhage from arterial lesions. Limbs amputated for hemorrhage complicating infected wounds have also shown vein involvement. And finally infective hemorrhage from the stump has followed amputation in cases in which dissection of the removed limb disclosed the presence of purulent phlebitis of main venous trunks.

Before leaving the description of the pathology of infective hemorrhage a few related clinical questions should be dwelt upon. In the first place we wish to indicate that the arterial pathology usually parallels the clinical course. For example the larger arterial defects with little or no thrombosis are found in sudden large hemorrhages more or less obliterating thrombi accompanying slight repeated bleedings. Early hemorrhages usually occur in cases of more gross wound sepsis the artery showing the severer grades of inflammation with numerous bacteria on the other hand bacteria are generally scarce and the evidence of arterial infection less marked in the later more delayed infective hemorrhage. Many interesting details and variations of the pathological pictures have been omitted in order to conform with the essentially clinical purpose of this paper. We have been all the more led to do so because we have found the arterial changes in infective hemorrhage consecutive to war wounds to be in every way identical with those in two cases of secondary hemorrhage (Cases 40 and 41) complicating ordinary infected wounds of civil life. The pathology of arterial lesion in the latter have no doubt been adequately described although we have been unable to find any reference to it. The point we wish to



Fig. To show the details of the termination of an arterial wall at the site of rupture. *A* Muscularis invaded by polynuclear and round cells abruptly ending at *B*. *C* Internal elastica. *L* ad intima folded over muscularis and the intima spread over it. The further outline of the vessel is indicated diagrammatically.

make is that the identity of the two pathologically is convincing evidence that a primary wound of the artery need not be invoked to account for secondary hemorrhage from war wounds. In fact the absence of any microscopic signs of previous injury to the artery, the invariable presence of infection, its equal or greater extent in the accompanying veins are all additional proof that infection and infection alone is the common cause of secondary hemorrhage. Our observations are not sufficiently extended to deny the possibility of an untreated arterial wound with or without added infection as the primary cause of a secondary hemorrhage but we certainly see no reason to believe that this is the usual cause.

The ideal treatment of the infective hemorrhage is of course prophylactic that is the prevention or the adequate control of wound infection. It is not germane to our subject to discuss these aspects of wound therapy. Dealing with the already infected wound we wish to discuss the operative procedures involved (in those wounds requiring surgical intervention) only in so far as the vessels are concerned. In the preventive treatment of infective hemorrhage and vein infection we

believe special attention should be paid to the main vessels in anatomic relationship to the wound. If they form part of the immediate wall of an infected tract they should be adequately exposed in the wound dissection and whatever form of chemical sterilization that is employed should be applied directly to their sheaths. Furthermore we believe that in infected wounds of several days duration such exposure of the vessels in proximity to the wound will not infrequently reveal already existing erosion of the artery and perhaps thrombosis of the vein for we have had several such experiences. The best treatment for these lesions can naturally be applied if they are encountered in this stage before a profuse hemorrhage has occurred and possibly before extensive vein infection is established.

Various methods of treatment have been employed in our hospital for the control of hemorrhage—packing of the wound, ligation or excision of the artery in the wound, resection of the artery with or without accompanying veins through a separate incision for their exposure (which we have termed surgical approach) and amputation. With increasing experience our views have been clarified and procedures originally employed



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would not now be attempted. For example, we have learned, as in inspection of our case, clearly how dangerous or even fatal it may be and often is to temporize with the slightest degrees of infective hemorrhage by packing the wound. Unnecessary loss of blood and even death from repetition of the hemorrhage have resulted and further extension of the infection has occurred because the significance of these minor hemorrhages was not at first clearly understood. I accept superficial wounds in which the bleeding evidently arises from granulation tissue we now know that the hemorrhage is almost certain to recur and that it comes from an arterial lesion. To defer surgical intervention there

is to remain in the great majority of cases to permit further loss of blood and to allow separation to go on unabated.

Amputation is indicated for most of the cases of infective hemorrhage from lesions of the popliteal or posterior tibial artery especially in the existence of fracture. The danger of death from sepsis or recurring hemorrhage is too great in most cases of this type to attempt to control the hemorrhage alone. Several of our earlier cases clearly support this statement. A discussion of the technique of amputation is out of place here but we wish to take up the treatment of the vessel when amputation is performed. In our series there will be noted several cases of in-

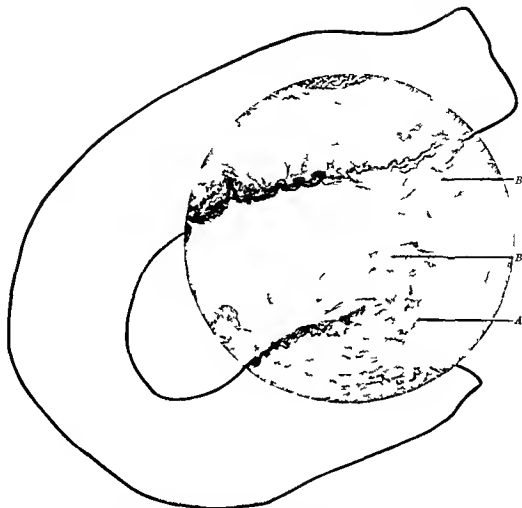


Fig. 3. Weier stain of cross section of artery at rupture to show the internal elastic lamina the abrupt termination of the vessel lumen and the small thrombus.

infective hemorrhage from the arterial stump after amputations for infection complicated by hemorrhage or for infection alone. Ligation of the artery at the level of amputation is therefore not sufficient when the amputation is performed through an infected field. If the patient's condition permits the little additional time we believe the main artery should be tied off in a non infected area and should usually be removed below the ligature even if it is necessary to dissect centrally for some distance to find that zone. At the same time the main venous trunk should be examined to determine if it is the seat of an infective phlebitis; excision beyond the purulent thrombus must of course then be performed if at all possible.

Finally we come to the question of the treatment of arterial lesion in infective hemorrhage in the large group of cases in which

amputation is not indicated. Our case reports show that hemorrhage recurred in 50 per cent of the operations consisting in ligation or resection of the artery in the wound or amputation stump and did not recur in any of the cases in which the artery was surgically exposed and resected in non infected or comparatively little infected fields. There are other arguments against ligation of the artery in the wound. (1) The source of hemorrhage cannot always be discovered or the rupture itself may be overlooked; this was true in several of our cases. (2) recurrence of the bleeding leading to renewed search for the vessel. (3) It is sometimes difficult to place satisfactory ligatures upon the artery in the depth of the wound, the exposure being necessarily inadequate and the vessel wall often friable. (4) The infected tract along the vessels is not laid open by ligation in the wound and there is



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no opportunity to determine the condition of the accompanying vein. The only argument we have seen advanced against ligation by surgical approach appears to be based upon the belief that the vessel must be ligated at a considerable distance from the wound with the possibility of resultant devitalization. In only two cases in our series (Cases 4 and 5) was high ligation performed and it was done solely because the site of the lesion was not determined. Subsequent wound repair progressed satisfactorily in both instances. Had devitalization or gangrene developed the case could still have been classified as exceptional ones with exceptional operations performed for the conditions encountered. The source of bleeding can be discovered in the great majority of the cases and the resection of the artery is almost invariably made not far from the confines of the wound. We therefore strongly advocate the surgical approach whenever feasible to the artery through a separate incision, its double ligation beyond the rupture and the infected tract and the resection of the portion between the ligatures.

The likelihood of infection of the reom pinyng veins is so great that they should be resected at the same time unless they are important venous trunks. In the latter case ex

amputation should be made for the presence of an infective phlebitis. If this exists the indication is clear. We have not as yet reached a definite conclusion upon the treatment of major veins when there is no visible evidence of their involvement for several of our patients have recovered without ligation or resection of such veins. At the operation for the hemorrhage one method would be the repeated aspiration of the vein under careful aseptic precaution to attempt to discover a thrombus. Failing this further treatment might await the bacteriological examination of the aspirated blood and a well the subsequent clinical course. On the other hand infected thrombi may be present in the vein when fluid blood has been obtained (as in two cases seen in our hospital) and a possibility of vein continuation following apiration always exists. The argument against resecting the vein with the artery without knowing whether there is vein involvement or not loses much of its force because the contributions made to the study of arterial lesions during the war appear to have definitely established the greater likelihood of a satisfactory circulation and the smaller chances for gangrene if the accompanying vein is ligated or excised when a torn artery is ligated or in aneurism resected. For this reason but especially because of the probability of vein involvement in infective hemorrhage we are at present inclined to believe that the accompanying vein should be ligated or resected even if an important trunk.

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## RTP RT F (AS)

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 nlyf All ar in luf in ch the cl  
 nnt mnt th urn f hemorrhage  
 othr el lly pmary r delayed primary  
 th rhg Whn the n l incomplete or  
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 ll fr l h em rhag a e though  
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### FEMORAL ARTERY

Case. Infant compound fracture of middle  
thigh of femur. Flap of skin admitted to the  
hospital in the evening day after the receipt of the

wound. The wound was incised and the purulent discharge began to decrease. On the seventeenth day after injury the patient had a slight hæmorrhage due to a small perforation in the femoral artery. The hæmorrhage ceased spontaneously but amputation was done on the twenty seventh day because of the continuation of sepsis. The patient died on the fortieth day after injury. Postmortem examination showed an extensive purulent thrombosis of the femoral vein extending into the common iliac.

**CASE 3.** Infected compound fracture of lower third femur. The patient was admitted to the hospital on the twelfth day after injury at which time he had a profuse hæmorrhage the source of which was unknown. The wound was packed and on the fourteenth day amputation was done because of the infection. On the thirtieth day he suffered another moderate hæmorrhage source unknown and an abscess in the stump at site of vessel was incised. The bleeding vessel was not found. The hæmorrhage ceased spontaneously. On the thirty fourth day the patient had another moderate hæmorrhage which was found to be due to a large defect in the femoral artery at 3 centimeters above the stump. There was an infected tract along the vessels. Treatment: resection of artery in healthy area 5 centimeters above the rupture (surgical approach). The result was satisfactory and the patient was evacuated on the fifty fourth day.

**CASE 3.** Infected thigh wound in region of vessels. The patient was admitted on the second day after injury and the wounds were dressed. The patient's condition was unsatisfactory. He had a septic temperature although the wound was apparently improving. On the thirteenth day the vessel were explored and an infection was found along the vessels. On the twenty third day there was a severe hæmorrhage due to rupture in the femoral artery. The artery was divided between ligatures. The patient died on the thirty second day. Postmortem examination showed purulent phlebitis of femoral vein extending into vena cava and pyæmic foci.

**CASE 4.** Compound fracture of lower third of femur slightly infected. The patient was admitted on the second day. The Carré Dakin treatment was administered and the patient improved. From the twentieth to twenty third days there were slight hæmorrhages and on the twenty fourth day a profuse hæmorrhage. The source of these hæmorrhages was not known. The four slight hæmorrhages were controlled by packing each time. In the case of the profuse hæmorrhage it was necessary to ligate the femoral artery above the level of the wound. This produced a satisfactory result and the patient was evacuated with solid union.

**CASE 5.** Infected thigh wound femoral artery doubly ligated for injury. The patient was admitted on the fifth day. The wound was dressed and the infection was partly controlled. On the thirteenth day there was a severe hæmorrhage source

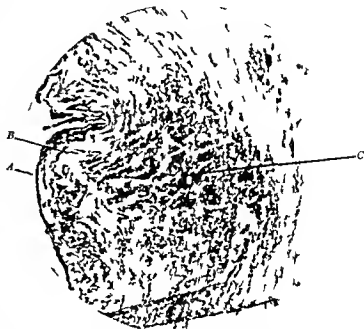


Fig. 5. Abscess in the muscularis C opposite the site of rupture. B lumen of elastic. Note the bulging of the arterial wall toward the lumen.

unknown which was controlled by packing. On the sixteenth day there was a second severe hæmorrhage source unknown which was controlled with difficulty by packing. On the twenty third day there was a moderate hæmorrhage probably from the femoral vein which was controlled by ligation. On the thirty third day there was a slight hæmorrhage from region of the vessels which was controlled by packing. On the thirty fourth day in the morning there was a severe hæmorrhage from the external circumflex artery (A) which was controlled by ligation. In the afternoon of the same day there was a moderate hæmorrhage source unknown which was controlled by resection of the femoral artery. The infection continued in the region of the vessel. On the fifth day there was a moderate hæmorrhage from a branch of the profunda femoris (B) which was controlled by ligation. On the seventy seventh day there was a moderate hæmorrhage source unknown which was controlled by packing. On the seventy ninth day there was a slight hæmorrhage controlled by packing. On the eightieth day there were several hæmorrhages probably from the profunda femoris (B) which were controlled by ligation. On the eighty fourth day there was a hæmorrhage from the femoral artery. The external iliac artery was ligated. The result was satisfactory and the patient was evacuated five weeks later.

**CASE 6.** Grossly infected fracture of tibia and fibula. The patient was admitted on the second day. The leg was amputated at the lower portion of the thigh and the stump became infected. On the sixth day there was a moderate hæmorrhage from a small branch of the femoral artery. The artery was ligated at the stump. The stump cleaned up slowly.





## GLUTEAL ARTERY

CASE 16 Infected wounds of spinal cord and buttock. The patient was admitted on second day. The wounds were incised and foreign body removed followed by transient improvement. On the fifth day there was a slight hemorrhage from buttock due to rupture of the gluteal artery (found at postmortem). The hemorrhage was controlled by packing. The patient died on the ninth day from meningitis.

CASE 17 Moderately infected wound of buttock. The patient was admitted on the thirteenth day. The Carrel Dakin treatment was administered and the condition improved. On the fifteenth day there was a severe hemorrhage source unknown which was controlled by packing on the eighteenth day there was a moderate hemorrhage source unknown which was controlled by packing on the nineteenth day there was severe hemorrhage due to rupture of the gluteal artery. The vessel was ligated in the wound but the patient died the same day. Postmortem examination showed infection localized to the wound.

CASE 18 Slightly infected wound of buttock. The patient was admitted on the third day. Carrel Dakin treatment was administered but the result was unsatisfactory and the patient continued to run a septic temperature. On the fifth day there was a moderate hemorrhage from rupture of the gluteal artery. The artery was resected in the wound. The sepsis continued but the wound improved. Death occurred on the twelfth day. Postmortem examination showed pus foci in the wound and lungs.

CASE 19 Infected wound of buttock. The patient was admitted on the second day. Carrel Dakin treatment was administered but the result was unsatisfactory. Suture of wound on the thirteenth day. The patient still ran a septic temperature and the blood culture was positive. On the twenty third day the wound was incised and foreign body removed but the sepsis continued. On the forty third day a deep abscess was incised. On the forty seventh day there was a profuse hemorrhage from rupture of the superior gluteal artery. Ligation at the sacrospinous notch gave a satisfactory result.

CASE 20 Flat infected wound of thigh. The patient was admitted on the seventh day. The wound was dressed. On the fourteenth day there was a slight superficial hemorrhage. The wound was picked and there was no recurrence.

## PERFORATING AND OTHER ARTERIAL BRANCHES

CASE 1 Apparently clean wound outer thigh. The patient was admitted on the fifth day. The dressing produced apparently satisfactory results. On the eighth day there was a very slight hemorrhage from an infection deep in the wound. There was a rupture of the superior perforating artery beyond the apex of the wound. The artery was ligated well at the profunda femoris by surgical approach. The result was satisfactory.

CASE 2 Infected wound of the popliteal region. The patient was admitted on the fourth day. Dress-

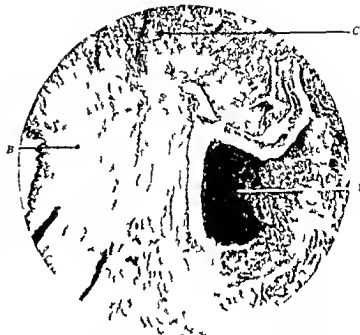


Fig 7 Suppurative parietal thrombus in infected vein at a level at which the artery B only shows oedema of the muscular. Infected granulation tissue C in which the vessel are embedded.

ings were applied. On the eleventh day there was a brisk hemorrhage due to rupture of the articular branch of the popliteal artery. Ligation by surgical approach with satisfactory result.

CASE 23 Grossly infected wound of upper posterior thigh. The patient was admitted on the second day. The wound was incised and much pus evacuated. On the fourteenth day there was an active oozing, hemorrhage source unknown which was controlled by packing. On the fifteenth day there was an active oozing hemorrhage source unknown which was controlled by packing. The patient was evacuated on the twenty second day.

CASE 4 Infected wound of upper posterior thigh. The patient was admitted on the second day. Incision of wound on fourth day but the infection continued. On the ninth day large blood clots appeared the source of which was unknown. The wound was picked and there was no recurrence until evacuation on the fourteenth day.

CASE 5 Superficial infected wound of buttock. The patient was admitted on the eleventh day. Dressings were applied but did not produce satisfactory results. The wound was sutured on the twenty first day. On the morning of the twenty third day there was a profuse hemorrhage source unknown and the wound was packed. On the afternoon of the same day there was a less severe hemorrhage source unknown which was satisfactorily controlled by packing.

## ANTERIOR TIBIAL ARTERY

CASE 26 Severely infected compound fracture of tibia. The patient was admitted on the second

day. The wound in the anterior tibial artery was situated beyond the root of the tract. The incision did not give satisfactory results and the purulent discharge continued. On the fifth day there was a black hemorrhagic due to rupture of the anterior tibial artery with effusion along the vessel. The anterior tibial artery was resected and approximated with sutures.

CASE 2. Infected fracture of tibia. The patient was admitted on the 11th day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the anterior tibial artery with effusion into the leg. The health improved and the patient recovered.

### INTERNAL TIBIAL ARTERY

CASE 3. Infected fracture of the tibia. The patient was admitted on the 11th day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the internal tibial artery with effusion into the leg. The health improved and the patient recovered.

CASE 4. Compound fracture of the tibia. The patient was admitted on the 11th day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the internal tibial artery with effusion into the leg. The health improved and the patient recovered.

CASE 5. Severely infected compound fracture of the tibia. The patient was admitted on the 11th day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the internal tibial artery with effusion into the leg. The health improved and the patient recovered.

### DORSAL PEDIS ARTERY

CASE 6. Infected fracture of the tibia. The patient was admitted on the 11th day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the dorsal pedis artery with effusion into the leg. The health improved and the patient recovered.

### BRACHIAL ARTERY

CASE 7. Compound fracture of the humerus. The patient was admitted on the second day. The wound was excised and sutured with an aseptic technique. On the sixteenth day a purulent discharge occurred. On the nineteenth day the wound was resected and approximated with sutures.

CASE 8. Infected fracture of the humerus. The patient was admitted on the second day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the brachial artery with effusion into the arm. The health improved and the patient recovered.

CASE 9. Infected fracture of the humerus. The patient was admitted on the second day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the brachial artery with effusion into the arm. The health improved and the patient recovered.

### MUSCULAR AND OTHER BRANCHES

CASE 10. Infected fracture of the upper humerus. The patient was admitted on the second day. The wound was excised and sutured with an aseptic technique. On the sixteenth day a purulent discharge occurred. On the nineteenth day the wound was resected and approximated with sutures.

CASE 11. Infected fracture of the upper humerus. The patient was admitted on the second day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the muscular branch of the brachial artery with effusion into the arm. The health improved and the patient recovered.

CASE 12. Infected fracture of the upper humerus. The patient was admitted on the second day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the muscular branch of the brachial artery with effusion into the arm. The health improved and the patient recovered.

### RADIAL AND ULNAR ARTIRIES AND PALMAR ARCH

#### MISCELLANEOUS

CASE 13. Infected fracture of the radius. The patient was admitted on the second day. The wound was excised and sutured with an aseptic technique. On the sixteenth day a purulent discharge occurred. On the nineteenth day the wound was resected and approximated with sutures.

CASE 14. Infected fracture of the radius. The patient was admitted on the second day. The wound was incised to the bone. On the 15th day the hemorrhage was very profuse. On the 17th day the patient died of hemorrhage due to rupture of the ulnar artery with effusion into the arm. The health improved and the patient recovered.

condition. On the seventeenth day there was a slight hæmorrhage source unknown also on the twenty first day. On the twenty ninth day there was a moderate hæmorrhage source unknown which was controlled by packing. There was no recurrence and the infection slowly cleared up.

CASE 39. Infected compound fracture of carpus. The patient was admitted on the third day. The wound was incised and bone fragments removed but the condition did not improve. On the eleventh sixteenth and seventeenth days revisions were made but the infection continued. On the twentieth day there was a brisk hæmorrhage from the radial artery (?) which was controlled by packing. On the twenty second day because of continued sepsis the limb was amputated. The infection was found to be located along the vessel sheaths and there was a large rupture of the radial artery. The subsequent course was satisfactory.

CASE 40. Abscess of palm following abrasion. The patient was admitted on the second day. The wound was incised but the result was unsatisfactory. On the fifth day an abscess of the forearm was incised. On the eighth day there was a moderate hæmorrhage source unknown which was controlled by packing. On the tenth day there was a severe hæmorrhage due to rupture of the ulnar artery and infection along the vessel sheaths. Resection by surgical approach controlled the hæmorrhage. On the eleventh day there was a moderate hæmorrhage due to rupture of the radial artery with infection along vessel sheaths. Resection of artery by surgical approach gave satisfactory results. The patient was evacuated on the twenty sixth day.

CASE 41. Compound fracture of metacarpus. The patient was admitted on the fourteenth day. On the fifteenth day there was a severe hæmorrhage due to rupture of the deep palmar arch. Resection of the artery in the wound controlled the hæmorrhage. Later abscesses of the forearm were incised.

CASE 42. Infected compound fracture of carpus. The patient was admitted on the second day. The wound was incised and bone fragments were removed but the infection continued. On the thirteenth day the wound was revised. Infection continued and the blood cultures were positive. On the twenty fourth day there was a brisk hæmorrhage due to rupture of the radial artery. There was a purulent tract along the vessels. Resection of the vessels by surgical approach gave satisfactory results. A subsequent resection of the carpus was done for pus foci.

CASE 43. Cellulitis of hand. The patient was admitted on the eighth day. Dressings were applied. On the ninth day there was a moderate hæmorrhage source unknown which was controlled by packing. There was no recurrence.

CASE 44. Abscess of palm. Patient admitted on third day. Incision of wound produced improvement. On the seventh day there was a moderate hæmorrhage origin unknown which was controlled by packing. There was no recurrence.

CASE 45. Infected wound of lumbar region. The patient was admitted on the fourth day. Incision of wound produced improvement. On the eighth day there was a moderate hæmorrhage origin unknown which was relieved by packing. Recovery satisfactory.

## TRANSPLANTATION OF BONE FOR DEFECTS OF THE HEAD AND NECK OF THE FEMUR<sup>1</sup>

By CHARLES DAVISON, M.D., F.A.C.S., CHICAGO

**AUTOPLASTIC** transplantation of bone is of value in three types of defects of the head and neck of the femur but in all cases the patient must be vigorous enough to withstand the operation and young enough as an economic possibility to warrant the attending discomforts and dangers of the procedure and the expense of time and effort required for a successful issue.

In a recent fracture of the neck of the femur without impaction may be repaired by grafting a segment of fibula across the line of fracture (Fig. 1). To obtain ideal results the repair should be performed early before the vitality of the capital fragment has been disturbed by closing of its blood supply. Under favorable conditions the union of the fracture resembles healing of wound by primary intention and without doubt the capital fragment retains its integrity and persists as a vital portion of the femur.

Case 1: B. A. male, 35 years, admitted to the hospital for treatment of the neck of the left femur on January 10, 1910 (Fig. 2). Transplantation of a segment of fibula across the line of fracture a perfect union soon as the routine examination and preparation had been completed. A roentgenogram taken three months after operation showed the transplant graft to both fragments with bony union of the fracture (Fig. 3). Three months later the patient had a complete union of the fracture and the hip joint was in a normal position. The patient was able to walk from eight to eleven hours daily. A lateral photograph taken here returned to show that he could sit for six hours with both feet together in the floor in the normal voluntary position for three months of the injured extremity (Fig. 4) in normal external rotation (Fig. 5) nearly normal abduction (Fig. 6) and with good flexion of the thigh on the pelvis (Figs. 7 and 8). He could sit for six hours on the heels of his supine position upon the toes of the injured extremity (Fig. 9).

A roentgenogram taken ten years after operation shows bony union of the fracture with substantial callus especially at the upper part of the neck and the distal end. The articular surfaces of the head of the femur and the acetabulum are free from callus (Fig. 4). The roentgenogram of the capital femoral cleavage is clear and distinct.

indicating healthy living bone. The early grafting of the fragments to the transplant and to each other has preserved the vitality of the capital fragment without sacrifice of regeneration of the bone.

II. Ununited fracture of the neck of the femur with diminished vitality of the capital fragment may be repaired by transplanting a segment of fibula across the non union (Fig. 1). Under favorable conditions the transplant grafts to the lower fragment in a manner similar to that in recent fractures. In the capital fragment the process is different. It stimulates the healing of wounds by granulation. There is a stimulation of osteogenesis by the transplant with projection of new bone cells into the devitalized fragment which acts only as a frame work for the deposition of new bone. The old bone is gradually absorbed as it is replaced by new bone. Under the stimulus of the transplant new bone is deposited in and around the area of the non

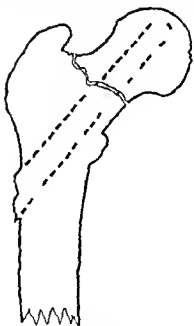


Fig. 1. a. Diagram of the femur showing the site of the fracture and the position of the transplant. The transplant is shown as a dashed line across the fracture. The capital fragment is shown as a solid line. The diagram is labeled 'Fig. 1' and 'a'.



Fig 2

Fig 2 Case 1 Roentgenogram of recent fracture of the neck of left femur



Fig 3

Fig 3 Case 1 Roentgenogram of autoplasmic repair of recent fracture of neck of femur three months after operation showing the transplant grafted into position with osseous union of the fracture



Fig 4

Fig 4 Case 1 Roentgenogram two years after operation showing bony union of the fracture with substantial callus between the upper part of the neck and the trochanter

union until the old fracture is obliterated. Later both the transplant and the new bone are absorbed and modified until there is

compensation between elasticity, strength and function.

CASE 2 F M male father aged 36 presented himself with an ununited fracture of the neck of



Fig 5

Fig 5 Case 1 Photograph six months after operation showing both feet of the patient to other in normal position



Fig 6

Fig 6 Case 1 Photograph six months after operation showing normal external rotation of the injured extremity



Fig 7

Fig 7 Case 1 Photograph six months after operation showing nearly normal abduction of the injured extremity



Fig 8

Fig 8 Case 1 Photograph six months after operation showing the amount of flexion of the thigh upon the pelvis



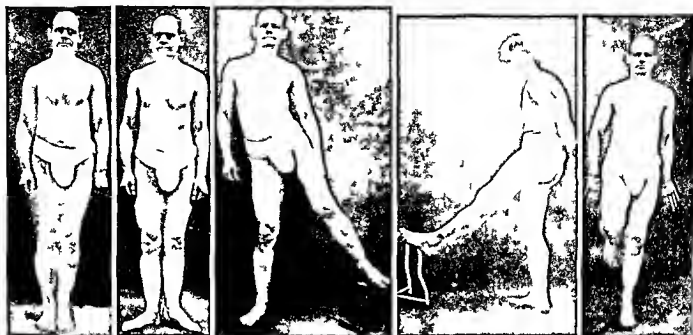


Fig 15

Fig 16

Fig 17

Fig 18

Fig 19

Fig 15 Case 2 Photograph four years after operation showing both feet together in normal rotation

Fig 16 Case 2 Photograph four years after operation showing external rotation of the injured extremity

Fig 17 Case 2 Photograph four years after operation showing abduction of the injured extremity

Fig 18 Case 2 Photograph four years after operation showing flexion of the thigh on the pelvis

Fig 19 Case 2 Photograph four years after operation showing patient supporting his entire weight upon the toes of the injured extremity

the outline was uneven. It appeared to be undergoing degeneration (Fig 11).

Transplantation of a segment of fibula across the pseudarthrosis was performed on January 15, 1915. After sixteen weeks of immobilization there was no motion either in the hip joint or the pseudarthrosis.

A roentgenogram taken six months after operation shows that the transplant had been driven through the soft capital fragment into the acetabulum. It shows bony union of the pseudarthrosis also between the transplant and shaft of the femur and between the transplant and the pelvis (Fig 12).

Vigorous efforts made to mobilize the hip joint were so successful that he returned to his work as a laborer two years after operation, earning full wages.

A roentgenogram taken two years after operation shows absorption of the upper end of the transplant so that the hip joint motion was possible. It shows the deposition of a strong mass of callus connecting the trochanter to the capital fragment above the transplant. It shows the replacement of the capital fragment by new bone, the old bone apparently acting as a limiting framework, shaping the outlines of the new bone. This is particularly apparent at the lower part of the capital fragment, where in the original roentgenogram (Fig 11) there was shown beginning disintegration of the surface of that fragment. This roentgenogram shows new bone breaking through at that point and forming an irregular nodule (Fig 13).

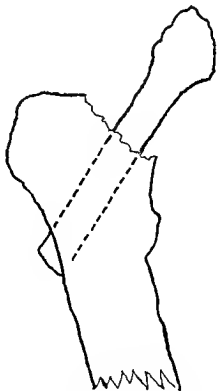
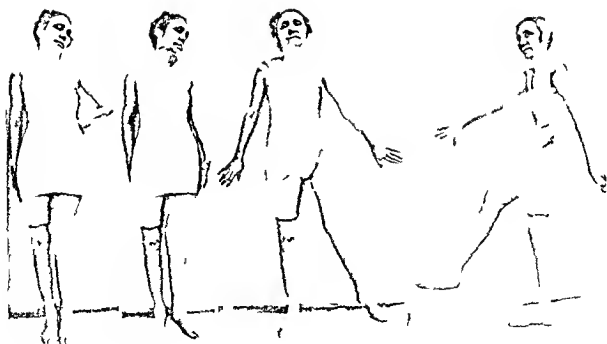
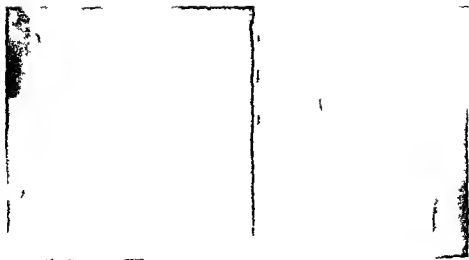


Fig 10 Diagram illustrating method of transplantation of the upper end of the fibula into the upper end of the femur to form a bony union with the acetabulum





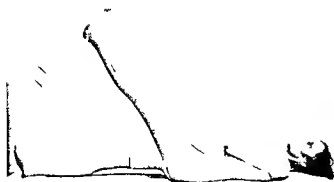


Fig 7 Case 3 Photograph one year after operation showing amount of flexion of the thigh upon the pelvis

illustrated by positional photographs taken four years after operation. He can stand erect with both feet together on the floor in the normal voluntary position of rotation of the injured extremity (Fig 15) and in normal external rotation (Fig 16). He has fair abduction (Fig 17) and fair flexion of the thigh on the pelvis (Fig 18). He can balance himself on the toes of the injured extremity (Fig 19). He is now working as a stock man in a wholesale sponge house earning a respectable living and supporting a family.

### III The head of the femur destroyed by



Fig 8 Case 3 Roentgenogram two years after operation showing hypertrophy of that part of the transplant between the femur and the acetabulum

injury or disease may be replaced and fair function reestablished by transplantation of the head and upper part of the fibula into the upper end of the shaft of the femur in such a manner that the articular surface of the head of the fibula will articulate with



Fig 9



Fig 30



Fig 31

Fig 9 Case 3 Photograph two years after operation showing amount of flexion of the thigh upon the pelvis

Fig 30 Case 3 Photograph one year after operation showing combined flexion and abduction

Fig 31 Case 3 Photograph two years after operation showing the patient's leg showing the injured extremity

the acetabulum (Fig. 3). Under favorable conditions the transplant will graft to the shaft of the femur. The part of the transplant which replaces the head and neck of the femur will hypertrophy until its size and strength are sufficient to meet the functional demand made upon the hip joint in walking.

CASE 3. C. K. female, age 15, presented herself with the history of an injury to the hip two years previous. She was complaining of great pain and was walking with the aid of crutches.

A roentgenogram taken at the time revealed an old fracture of the neck of the femur with loss of the capital fragment (Fig. 1). Transplantation of the upper end of the shaft into the upper end of the femur was performed on April 5, 1916. In mobilization by a body plaster of Paris cast was maintained for six months. This was followed by vigorous physical exercise continued until walking was permitted. A roentgenogram taken one year after operation shows the transplant grafted to the femur with the ilio-femoral of the trans-

plant in good position in the acetabulum (Fig. 2).

One year after operation the patient could stand erect with both feet together on the floor in the normal voluntary position of rotation of the injured extremity (Fig. 3) and with a fair degree of voluntary external rotation (Fig. 4). She had a fair degree of abduction (Fig. 25) and nearly one half of the normal voluntary flexion of the thigh upon the pelvis (Figs. 6 and 1). She was not permitted to walk without support for two years after operation.

A roentgenogram taken two years after operation shows the transplant in position in the acetabulum, that the part of the transplant within the shaft of the femur has persisted without either absorption or hypertrophy, that the part of the transplant between the femur and the acetabulum has markedly increased in size, that a strong bony union has been deposited in the angle between the upper end of the femur and the transplant (Fig. 25).

Two years after operation he could walk, she could go up and down stairs, she could flex the thigh sufficiently to cross the normal thigh while sitting (Fig. 1) she could tie the shoelaces on the foot of the injured extremity while standing (Fig. 3).

## NOTE ON THE RECURRENCE OF EXOPHTHALMIC GOITER AFTER THYROIDECTOMY

By H. G. SLOAN, M.D., F.R.C.S., L.S.M.S., L.D.S., D.O.  
(C. P. M. D. U. A.)

THE recurrence of thyroid enlargement with the characteristic symptoms of exophthalmic goiter in a small percentage of cases after the primary removal of from two thirds to four fifths of the gland shows that the etiologic factor that caused the original growth must still be active.

A study of the case histories of patients suffering such recurrence has led the writer to believe that in many instances if not always the exciting cause of exophthalmic goiter and of its recurrence will be found to be an infection—usually focal in character—which must be eradicated before cure is possible.

The low resistance of patients with exophthalmic goiter to pyogenic infection is well recognized. Their systemic reaction to an acute attack of influenza or tonsillitis for example is far in excess of the reaction in a normal individual.

In those cases which are clinically cured after the primary operation immunity to the focal infection has resulted from the lessening of the intoxication by the partial removal of the thyroid and by the postoperative rest and gain in weight. Certain cases however do not secure a permanent immunity though they may gain in weight and the extreme symptoms are relieved. In these a persistent mild tachycardia and pyknicardia with symptoms of lack of nervous stability bear witness to the continued presence of some exciting factor. In some of these cases immunity may be secured by the removal of more of the gland. In patients from twenty to fifty years of age it is well to remove four fifths of the gland while in older patients—from fifty to seventy years of age—two thirds is usually sufficient since the activity of the thyroid diminishes with advancing age.

When the removal of the maximum amount

of the gland does not cure then the exciting cause must be sought and removed as otherwise any existing focal infection will continue to stimulate the remainder of the gland

In some cases in which tachycardia is a marked feature rather than the so called pyknicardia—the forcible heaving throb which is due to the adrenal component in exophthalmic goiter—the primary operation has been the result of a faulty diagnosis. The principal etiological factor in these cases is tuberculosis or intestinal stasis. Such patients can only be harmed by further surgery.

This forcible heart beat under nervous stress is the most reliable guide in the differential diagnosis of exophthalmic goiter.

During the last twelve months we have observed five cases from our own and other clinics which have been cured of their recurrent symptoms by the eradication of focal infections. Our observations on one of these cases in particular crystallized the author's ideas on the role of infection in the etiology of exophthalmic goiter.

Two years previously this patient had had a double ligation followed by the removal of four fifths of the thyroid. He returned to almost a normal condition except that he never fully regained his nervous equilibrium and remained a little underweight. He consulted us again because he was losing weight—he had lost eight pounds in the preceding two months. That his condition was due to a recurrence of the disease was evidenced by the vascularity of his skin—the so called goiter blush—the forcible and rapid heart beat—the tremors and the thrill felt over the superior vessel supplying the remnant of the thyroid which was beginning to hypertrophy and was tender to pressure.

Examination at first revealed nothing which could account for the recurrence though at either angle of the jaw where the tonsillar lymphatics drain slightly enlarged cervical gland could be palpated. Nothing else indicated any pathological condition in the tonsils which were of the buried type.

Suspecting therefore that the strain of his law practice must be accountable for his condition the patient was advised to take a trip to California. He returned in two months showing no sign of improvement. Just at this time however he had a severe attack of tonsillitis and this gave us the

clue. Two weeks after tonsillectomy he felt more tranquil was less excitable under stress. In two months he had regained his lost weight, his pulse rate had become normal and the thrill and tenderness had disappeared from the thyroid remnant which had returned to its normal size.

Four cases have had a similar history and have shown equally satisfactory results after the removal of the focus of infection. Two other cases developed acute articular rheumatism after thyroidectomy before the tonsils were removed.

These observations on the relation of chronic infection to exophthalmic goiter have altered the author's method of procedure in primary severe cases. *Focal infections are eradicated first* if possible if not then as soon as possible after the ligation or lobectomy thus attacking the disease at its origin. In our examination of the body for foci of chronic infection we have most frequently been able to locate the trouble in the nasopharynx and mouth. Thus a history of recurrent sore throat with the presence of enlarged deep cervical glands is considered sufficient evidence to justify a tonsillectomy even though the tonsils may look normal when the anterior pillar has been drawn aside in order to make the patient gag.

The condition of the teeth invites the closest scrutiny. If the presence of a root abscess is revealed by the X-ray the tooth should be extracted. Temporizing with pyorrhea invites disappointment. Extraction of the involved teeth is the only sure means of eradicating the trouble. The exposure to the X-ray of infected sinuses that resist all other methods of treatment has given very good results.

The author has found that even fulminating cases of exophthalmic goiter will stand tonsillectomy under anesthesia better than one would suppose.

Several days after the eradication of the focus of infection the superior thyroid arteries are ligated and the patient is then sent home to carry out a carefully planned dietetic regimen with complete rest for two or three months before the thyroidectomy.

## VESICAL DIVERTICULUM

## A CLINICAL ANALYSIS OF 1 CASES

BY HANK HINMAN M.D. F.A.C.S. SA. FRANCISCO

**D**IVERTICULUM of the bladder has been long regarded by the general medical profession as a rare and unimportant anomaly of little significance unless complicated by stone or infection and in itself of no surgical importance. During the last decade interest in the condition has grown and numerous contributions have been written by eminent urologists and surgeons. Since it has no distinctive symptomatology and definite clinical recognition is impossible without the use of the cystoscope or cystogram and undoubtedly heretofore many cases have been overlooked or wrongly diagnosed.

## INCIDENCE AND DIAGNOSIS

The fact that in less than four years 21 cases of diverticulum have occurred in the writer's practice indicates that the condition is by no means rare. There were two women in the series which is unusual. The ages varied from 37 to 77 with an average of 56 years. There were only three cases under 50.

The cystoscope and X ray have been found essential in making an absolute diagnosis. The cystoscopic study should be systematic and the method advocated by Young or as illustrated by the chart (Fig. 7) insures thoroughness. A careful cystoscopic search may fail to discover the orifice of the diverticulum and the determination of the position of the diverticulum by the necessary interpretation of the cystoscopic pictures is often faulty. An estimation of the size of the pouch is difficult even when insertion of the cystoscope into the pouch is possible and the size and character of the orifice is unreliable as an indication.

For the above reasons the importance of the cystogram is universally recognized but

no previous writer has emphasized the importance of making contrast cystograms. The following technique is used. After the bladder has been filled by the gravity method and a plain cystogram taken the injection solution is drained off and the bladder immediately refilled with air by injection with a double crutery bulb through the urethral catheter. The second X ray plate the contrast cystogram is now taken. The air filled bladder stands out in marked contrast to the pouches which have not had time nor opportunity to empty themselves of the X ray solution (Figs. 1 and 2). In several cases pouches that were indefinite or not shown at all in the simple cystogram were beautifully demonstrated by the contrast method (Figs. 3, 4 and 5) and in a few cases a supposed diverticulum with the plain cystogram was disproved by the contrast cystogram (Fig. 6).

Furthermore the contrast method will usually give a fairly accurate record of the number and relative size of pouches. It is the exception for the diverticulum not to remain filled after bladder drainage nevertheless failure to get a contrast picture is not proof of the absence of a diverticulum.

Consequently neither cystoscopy nor cystography alone is sufficient but when cystoscopy, plain cystography and contrast cystography are properly used in conjunction they establish a definite diagnosis.

## POSITION AND STRUCTURE OF DIVERTICULA

In the 17 operative cases in which definite confirmation of the presence, number and position was made by direct examination there was 1 single diverticulum in 11 and multiple diverticula in the other 6, two being present four times and three and four once each (Table 1). The single accumulation was located in the neighborhood of the left ureter seven times and near the right ureter

four times. In 3 cases with two pouches there was one near each ureter and in the fourth case both diverticula were near the right ureter but there was a deep cellulite near the opposite ureter in this case. In the case with three pouches there was one near each ureter and a third opened at the base some few centimeters above the interureteral ridge. The one case (Case 5) with four diverticula is most remarkable three being multiloculated with two orifices one of which opened above and the other below the right ureteral orifice and the fourth diverticulum had a huge orifice which swallowed the left ureteral meatus and ridge.

Although there may be considerable error in the cystoscopic localization of diverticula in the unoperative series of four cases three apparently have a single diverticulum the opening of two being above the right ureter and near the left ureter in the third. In one case (Case 21) multiple orifices were seen apparently one each near the two ureters and several openings of deep cellulose or pouches in the base.

It is a striking fact that in not a single one of these 27 cases was the region of the ureters uninvolved. In a few instances the orifice was located several centimeters beyond the ureteral papilla (the greatest distance was about 4 centimeters which is relatively close in view of the marked bladder dilatation) but it was always definitely to the right or left and in the immediate neighborhood of the respective ureteral orifice. The mouth of the diverticulum was found located definitely in the base only when multiple pouches were present.

A rather significant fact not heretofore emphasized is the appearance and location of deep cellulites (Table I). In a few cases these were of such size as to be definite pouches. In the present consideration only those are indicated that at operation would admit the tip of the index finger for about 2 centimeters. Pouches of this size were demonstrated in the cystograms in seven instances. They are larger and deeper than the ordinary cellulite but at operation do not appear of sufficient size to warrant operative removal. Such a deep cellulite was demon-

TABLE I—LOCATION OF DIVERTICULUM AND OF ASSOCIATED CELLULES

[illegible]

strated near the opposite ureteral meatus in all but 2 of the 11 cases of single diverticulum. In all but one case (Case 5) of multiple diverticula there were deep culles at the base one of which (Case 9) was large enough to justify removal.

All of the large diverticula were forced to dissect their way posteriorly between the rectum and proctovesical region. This is probably the mechanical result of intra-abdominal pressure. At operation the sacs seemed to hang as by gravity from their necks so that upon distention they would force the posterior wall of the bladder upward and when of large size would occasion marked obstruction to urination in very much the same manner as intravesical hypertrophy of the prostate itself. In those instances in which a mass was palpable suprapubically in patients just before urination to disappear afterward the mass was probably the full distorted bladder itself pushed up by the distended pouches underneath.

In one striking instance (Case 9) a large diverticulum because of its deep position posteriorly and its thick infiltrated walls was mistaken for a right lateral prostatic hypertrophy. This is excusable in view of the firm rounded mass palpable per rectum in the position of such an hypertrophy, of the intravesical bulging of the distended sac at cystoscopy giving the impression of a huge lateral lobe and obscuring from cystoscopic view the orifice of the diverticulum and of the irregular shadow shown in the contrast cystogram being wrongly interpreted as an incompletely emptied bladder (fig. 20).

**Hydro urachus.** This series is unusual in the failure to find at operation a single diverticulum opening on the anterior bladder wall. In the literature are a few reports of a pouch with its orifice at the apex in the region of the urachus. One such patient (Case I C 304) a girl age 8 has come under the writer's observation in whom following the ligation of a spina bifida sac when 8 days old paralysis of both legs and incontinence of urine developed. The muscular paralysis slowly disappeared but the urinary incontinence has persisted with only partial control of the rectum. Several years ago following catheterization pyuria supervened. The catheter has been used by the mother almost daily since. About two weeks ago a small mass was noted in the suprapubic region with a swelling under the umbilicus which was thought to be an abscess. Upon incision considerable purulent urine was discharged and a urinary fistula formed. Phthalein November 1, 1916 10 minutes 10 per cent 8 per cent November 5, 10 minutes 5 per cent 6 per cent. Cystoscopic examination shows a markedly enlarged and trabeculated bladder with a diffuse granular inflammation. Bladder capacity over 800 cubic centimeters. Behind each ureteral orifice are several deep celluloses and others are seen posteriorly in the fundus. It was not possible to localize the patent urachus. (Cystogram was not made.) Ureteral catheterization showed bilateral pyonephrosis. At autopsy four months later a dilated and patent urachus was found.

TABLE II—SUMMARY OF PATHOLOGIC FINDINGS

C m	D cul m	S cul m	l kne w ill	fl rat m
s	3  6 7 8 }	9 5x4 8 5 7 d 3 5x4 7 0 3	5 4 8 3 0 5 5	Fig 4 Fig 5 F F ? FL Fl 8 F
a		7 7 6 5 5 7 3 5x3 4	3 5 5 5	
g	1  6  8	7 3 6x4 3		
e 7				

tinctly different from those formed in the neighborhood of the ureter or base. It is in fact a uro urachus or hydro urachus and the inclusion of such cases as vesical diverticula leads to confusion.

The difficulty of accurate cystoscopic localization of the orifice of a diverticulum may be again referred to. In many reports in the literature the position of the orifice was determined by cystoscopy alone no mention being made of the operative or autopsy findings. Such reports are somewhat unreliable. The apparent discrepancy between cystoscopic and operative findings is excusable. Cystoscopic pictures demand interpretation and faulty interpretation is common where subvesical pouches have distorted normal vesical outlines.

## PATHOLOGY

The diverticula removed at operation varied in size from 5 by 2 by 1 to 11 by 10 by 13 centimeters or about that of a large marble to a croquet ball. The walls varied markedly in thickness for the different diverticula and usually quite markedly for the different portions of the same diverticulum. This was particularly noticeable after fixation upon holding the diverticulum up to the light when thin and thick areas in the wall were immediately apparent. The smaller diverticula usually had relatively thinner walls than the larger ones. The

thickness varied from 0.5 millimeters to 5 millimeters

Histological study reveals two unexpected findings: absence of epithelial lining of the lumen (with one exception Case 10) and of any uniform muscular wall in definite layers. The diverticula had been packed with gauze at the time of operation to facilitate removal and it is possible that this packing and the manipulation consequent to freeing the sac wall from peritoneal and other adhesions may have resulted in marsupialization of the mucosa. It seems unlikely that this trauma should have been so universally complete.

The inside of every sac had a smooth glistening surface like parchment and unlike the dull velvety appearance of healthy mucosa. In Case 7 a small fragment of dead epithelium was found at the surface and in Case 10 a very thin layer of flattened epithelium lined the lumen altogether different from bladder mucosa. To a varying degree but universally the superficial layer next the lumen showed a chronic inflammatory reaction with engorgement of blood vessels and round cell infiltration. polymorphonuclears being exceptionally found. This appearance simulated organizing granulation tissue on some of the surfaces.

The muscle was invariably scattered in bands interwoven with dense connective tissue and in some of the walls the connective tissue bands outproportioned the muscle bands. The muscle bands were sometimes cut transversely longitudinally or obliquely and in a few a circular and longitudinal layer was indicated but in not one case were definite muscle layers as found in the bladder wall demonstrable. Even when the musculature was heaviest it occurred as bands distributed in dense connective tissue and commonly with no definite arrangement.

#### SYMPTOMATOLOGY

The clinical evidence of a vesical diverticulum is most uncertain. The condition is popularly regarded as symptomless until the advent of infection, stone formation or some such complication. A study of this series fails to support this belief. The duration

TABLE III—CASES GROUPED WITH RESPECT TO TYPE OF PROSTATISM AND TO SHOW THE RELATION OF INITIAL SYMPTOM TO ONSET OF PYURIA

		Contractile Neck	
		Contractile	Non-Contractile
Case	Age	Initial Symptom	Time from Symptom to Pyuria
			Years
5	5	Frequent dysuria	Years
	6	Intermittent hematuria	7 1/2
	55	Complete urinary retention	5 1/2
	5	Intermittent hematuria	5 1/2
	28	Intermittent hematuria	5 1/2
7	54	Intermittent hematuria	5 1/2
	67	Intermittent hematuria	5
10	74	Intermittent hematuria	Years
	75	Intermittent hematuria	Years
18	15	Intermittent hematuria	Years
	15	Intermittent hematuria	Years
Prostatic Hypertrophy, small fibrous type			
4	7	Intermittent hematuria	Years
	5	Intermittent hematuria	Years
	55	Intermittent hematuria	Years
Prostatic Hypertrophy, glandular type			
8	68	Intermittent hematuria	Years
	69	Intermittent hematuria	Years
Prostatic Hypertrophy, calcareous type			
4	6	Intermittent hematuria	Years
	6	Intermittent hematuria	Years

of symptoms averages 16 years but the duration of infection when present averages only about 6 years and five cases showed no evidence of present or previous infection (Table III). One case only (Case 18) was complicated by calculus formation. Undoubtedly these two complications may aggravate symptoms just as they do in any condition of prostatism but in view of the often prolonged periods between the onset of symptoms and their advent to say nothing of their complete absence in many cases cannot be justly regarded as wholly responsible.

Obstruction to urination is obviously the principal factor in symptomatology. This obstruction is primarily the result of contracture of the vesical neck (Cases 1 to 13) of prostatic hypertrophy (Cases 14 to 19) of urethral stricture (Case 15) or prolonged vesical tenesmus. Secondly the diver-

Case 18, when the obstruction is bilateral, the result of



ticulum itself upon distention may be so situated as to obstruct further the urinary pathway and by its presence increase residual and predispose to infection. In a few cases the ability to urinate a large quantity almost immediately after having apparently emptied the bladder (as in Case 10) or the appearance of a suprapubic mass before to disappear after urination (as in Cases 9 and 11) have a true clinical significance. The persistence of pyuria with difficulties in urination and residual in prostatic following prostatectomy (as in Case 9) is further clinical evidence of the presence of a diverticulum. The initial symptoms (Table III) the course of the disease and the terminal pictures might be duplicated by a study of any series of severe prostatism and it would appear that diverticulum of the bladder is not a distinct clinical entity.

The relationship of contracture of the vesical neck to vesical diverticulum has never been emphasized. The most striking fact of this analysis is that 13 cases which were led by a review of the literature to believe would be universally considered as congenital types had contractures and in four others prostatic hypertrophy was of no significance and so clearly of the fibrous ring type as to be rightly considered an exaggerated type of contracture. In 3 of these fibrous hypertrophy cases multiple prostatic stones were found. In only 2 of the 13 cases was glandular hypertrophy present. In none of the group associated with enlargement of the prostate were the diverticula of any considerable size. It is further significant that in the same period covered by these 13 cases of diverticulum more than 150 cases of enlarged prostates have been examined and a diverticulum found in only 6. In 2 cases of the series both in women a definite finding of obstruction to urination is wanting. Both of the 2 cases give a prolonged history of repeated attacks of pyuria and there is a reasonable doubt of the priority of the diverticulum and of the infection. With a prolonged infection a contracture of the vesical neck is not improbable and the findings at the operation in these two cases will have an interesting bearing on this question.

The following series of 13 cases will be analyzed with reference to incidence pathology diagnosis and symptomatology.

CASE 1. Male age 57 U. C. H. No 1096. The patient voids every hour during the day and four to six times at night suffering marked pain before and after urination. There is almost continuous urgency. The urine is loaded with pus. The patient has had several attacks of neisserian infection history otherwise is negative.

About 20 years ago he was treated by dilatations with cold sounds for premature ejaculations. Before this he had noted some frequency and difficulty in urination. Following these treatments he had complete and continuous incontinence for about 2 months for which he wore a urinary control of urination was gradually regained but the frequency and urgency persisted. There was great pain in the bladder before and after urination and the urine was continuously very cloudy. Five months ago bleeding for 2 days was first noted two weeks later there was a second short attack of hematuria.

The patient shows cardiac hypertrophy with a systolic murmur transmitted to the aorta. The Wassermann is negative. Blood pressure 110/60. The urine is loaded with pus and organisms no cysts. Culture shows bacillus pyocyanus. Phthalcin (antisthamin) March 9 10 minutes 22 per cent 3 per cent March 14 10 minutes 40 per cent 3 per cent March 16 10 minutes 0 per cent 33 per cent March 21 blood urea nitro 5.1 milligrams per 100 cubic centimeters. Rectal examination prostate is not enlarged median lobe not enlarged but marked. No calculus all.

Cystoscopic examination shows no intravesical enlargement of the prostate. Bladder wall is markedly trabeculated particularly posteriorly and in the region of the right ureteral orifice. Three cellulae are seen one of which looks like the orifice of a diverticulum. To the left about 1 cent meters above the left ureteral orifice is a small diverticulum into which it is not possible to insert the instrument. The internal urethral orifice is enlarged and hypertriphied but on cystoscopic study no definite contraction of the ejaculatory duct is noted.

Per urethral palpation revealed a slight thickening of the bar between the shaft of the instrument and the examining finger.

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*Operation March 6* Marked pericystitis and peridiverticulitis are present making it impossible to strip the peritoneum from the diverticulum without tearing. An attempt to reconvert the sac and remove it intravesically was unsuccessful. The sac was picked with gauze and dissected free from the ureter which was adherent to it posteriorly but opened independently into the bladder. The small pouch near the right ureter admitted the tip of the index finger no prostatic hypertrophy could be demonstrated. The finger could be inserted into the urethra with some difficulty and the suprapubic view gave the appearance of a moderate contracture. Specimen removed is shown in Figure 4.

Convalescence was uneventful until May 31. The suprapubic wound had completely closed on May 25. Phthalein on the 20th was 10 minutes 5 per cent and 1 per cent and the urine was still very purulent. The urethral catheter had been removed on May 26 and the patient had been voiding naturally for 4 days. On May 30 he ate a very hearty dinner including blackberry pie and was seized the next day with severe epigastric cramps. The bowels had not moved for 4 days and all enemata had been unsuccessful. On June 1 he vomited greenish colored fluid and complained of more abdominal pain. Blood urea nitrogen was 28 milligrams per 100 cubic centimeters. By June 2 there was marked abdominal distention and definite fecal vomiting. Blood urea nitrogen 49.4 milligrams per 100 cubic centimeters.

*Operation* Dr Saxton Pope. Fifty cubic centimeters of clear straw colored fluid were evacuated from the peritoneal cavity; there was a large mass of adhesions in the midline just below the umbilicus. Enterostomy. The intestine was opened the next day and about 600 cubic centimeters of greenish brown fluid escaped. On June 7 the patient had good bowel movement and his condition was much improved. On June 10 cramp like abdominal pains recurred and there was slight abdominal distention. The bowels did not move for 4 days and vomiting began again. On June 14 urea nitrogen of the blood was 90 milligrams per 100 cubic centimeters. On June 17 a second enterostomy was performed. The portion of the intestine below the old enterostomy sac was collapsed and bleeding and the intestines above distended. The patient died on June 24. Autopsy was not performed. Death was due to chronic peritonitis intestinal obstruction and pyelonephritis.

CASE 2. Male age 67. U C H No 11810. The patient has marked urgency hesitancy and dribbling. The stream is very small and there is pain in the bladder at the time of urination. There are many blood clots and purulent particles in the urine.

The patient had small pox at 8, measles infection at 18 and rheumatism at 40. About 10 years ago during an attack of rheumatism he had his first pain in the bladder region following which hesitancy and intermittent urination soon devel-

oped. The stream became small and there was considerable burning and pain on each urination. About 5 years ago he began to pass small particles in his urine which have persisted up to the present. For the last few years there has been marked pain low in the back intermittent in character. Blood was first noted in the urine 10 years ago and has been present off and on since.

General examination was negative. The Wassermann was negative. Blood pressure 125-75. The urine is quite purulent and contains many red blood cells no casts many bacilli and cocci. Phthal. Aug. July 4 14-8-2 July 31 11-36-18. Rectal examination prostate is not enlarged notch and furrow well marked.

*Cystoscopic examination* Bladder capacity 1800 cubic centimeters. Residual 500 cubic centimeters. There is no intravesical hypertrophy. The mouths of two diverticuli can be seen opening to the right of the midline above the trigone on the posterior wall. The beak of the cystoscope can be inserted into the upper one which is the larger and about 3 centimeters from the right ureter. Its walls show a pronounced inflammatory reaction but no trabeculation and no stone is seen. The lower opening is about 1.5 centimeters above the right ureter to the outer side of the one just described. The bladder wall in the region of the left ureter is trabeculated and shows marked cellulose formation. Recto-urethral examination shows no thickening of the prostate and only the suggestion of a fibrous bar. The patient was taken to the X-ray room and rather unsatisfactory plain and contrast cystograms made which showed one large right sided diverticulum.

*Operation August 4* Suprapubic extraperitoneal excision. The bladder was dissected free of the peritoneum which could be rather easily stripped back although somewhat adherent to the upper and larger of the two diverticuli. The bladder was opened and the opening incision extended to the mouth of the large diverticulum which was packed with gauze so as to facilitate its separation from its peritoneal covering. After removal of this large diverticulum the smaller pouch could be felt extending down between the rectum and the prostate. It was packed with gauze to facilitate its dissection. The ureter was freed and did not communicate with this sac. Incision in the bladder was extended down to the mouth of the opening and the sac was removed by circular incision. Two specimens are shown in Figure 5. A large cellulose easily admitting the finger tip was present near and above the left ureter.

The patient's condition after operation was good. He developed a persistent hiccuph on August 8 and the abdomen became distended. Repeated enemata cathartics stools and escerin hypodermically did not relieve his bowel condition satisfactorily. The patient developed fecal vomiting on August 11 which continued in spite of repeated stomach washings. Enterostomy operation August 11 by Dr Pope to relieve the paralytic ileus. The



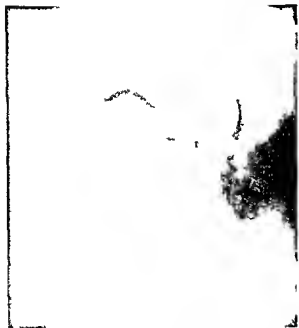


Fig. 1 Cystogram Case 1. Large diverticulum on left side. Markedly dilated and tortuous ureter on the right with a large cellule below it opening into the bladder.

Recto urethral examination shows a definite bar at the neck which the beak can be felt to override. Cystogram shows a large diverticulum posteriorly to the left with a small pouch in the region of the right ureter. The patient was put on preparatory treatment and residual reduced to 120 cubic centimeters.

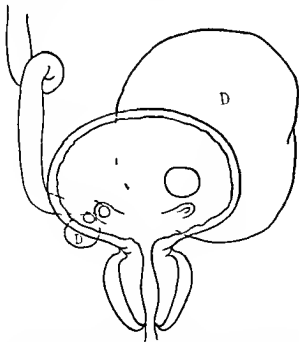


Fig. 3 Diagram of conditions in Case 1. Dilated right ureter and orifice with deep cellule below. Orifice of diverticulum above left ureteral meatus which is not dilated.

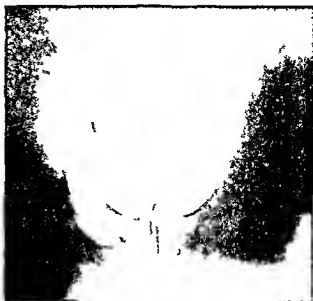


Fig. 2 Contrast cystogram Case 1. The diverticulum dilated ureter and large cellule have remained full of thorium nitrate and stand out in marked contrast to the air-distended bladder lying in which is seen the coiled end of the urethral catheter.

*Operation May 10.* Suprapubic extraperitoneal excision. There was a marked stricture at the neck which was divided with Young's punch and bleeding controlled by direct cauterization with a Paquelin. Examination after opening the bladder showed that there were small pouches on either side near the ureteral orifices which were so shallow that it was not considered necessary to excise them. Orifice of specimen removed (shown in Fig. 4) was only

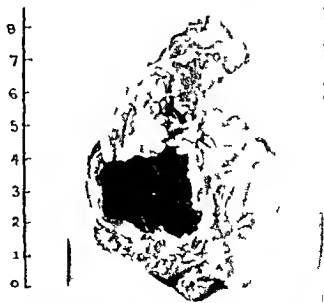


Fig. 4 Photograph of diverticulum removed in Case 1. It has been preserved in formalin and has been taken from below its limit of distensibility (see Table II).

patient died that afternoon Autopsy report Chronic diffuse nephritis interstitial type a uterine hemorrhagic cystitis bilateral acute ureteritis bilateral pyelitis acute splenic tumor parenchymatous and fatty degeneration of the mitral valve hypertrophy of the heart acute bronchopneumonia pulmonary edema and emphysema chronic pulmonary tuberculosis chronic adhesions pleuritis intestinal obstruction (paralytic ileus)

CASE 3 Male age 50 The patient has a supra pubic urinary fistula through which practically all the urine drains

He has had unusually good health although he has had several infections several times

For a great many years (25 to 30) slight difficulty in urination has been noted which was attributed to urethral stricture Four years ago he was unable to void at all until after one hour's straining when there was slight dribbling attended with much pain and burning For this he received sounds and dilatations during the next three months with little improvement He then entered a hospital for one week where bladder irrigations were given During these few months on account of the straining severe and painful hemorrhoids developed For the next three years urination very and extreme difficulty continued During the last six months of this period he used a catheter regularly about every four hours In October of this patient had become so weak that he was unable to care for himself and again entered a hospital and a suprapubic cystostomy was done under local anesthesia After six months of suprapubic drainage the patient was given a general anesthetic and an attempt was made to close the suprapubic fistula which however broke open a few days later Eleven months in the hospital eleven months lying in bed and ever since practically all of his urine has drained through the suprapubic fistula

General examination a negative Blood pressure 14/18 Lethal in 30 minutes 36/10 Urine is markedly purulent with an occasional blood cell no casts abundant bacilli Rectal examination Prostate nontender 1 m. in circumference shallow and the not his cell mass is soft and elastic and the lateral sulci shallow

Cystoscopic examination of the urethral strictures It was necessary to depress the instrument considerably to reach the third bladder wall stricture The bladder mucosa is rough and leathery with the appearance of mild encrustation cystitis in small portions The bladder is markedly trabeculated and numerous celluloses are present posteriorly The mouths of the diverticula are seen on small about 4 mm. in diameter just above the left ureter and another large diverticulum in diameter to the right of the middle about 3 centimeters above the right ureteral orifice This sac evidently ballooned out beneath the bladder wall thus pushing it up so that it is difficult to depress the instrument sufficiently to see the orifice of the diverticulum and it is not possible to see the neck of the diverticulum

ment into it Ropy masses of pus can be seen floating out of the mouth The prostatic orifice is slightly irregular but presents no definite sac or intravesical projections There is however a definite median bar formation

Operation March 8 Extraperitoneal excision Specimen shown in Figure 7 Large cellulose at base Both diverticula near the respective ureters Conditions as found are shown in Figure 6

Convalescence as uneventful The suprapubic fistula however closed slowly and would remain closed two to three days at a time and then reopen partially Urination through the urethra was difficult and frequent The patient at his request left the hospital with a slight suprapubic leakage

Cystoscopic examination October 27 showed bladder capacity 60 cubic centimeters residual 10 cubic centimeters with pronounced contracture of the neck The patient was readmitted October 29 A Young's punch operation was performed under local anesthesia bleeding being controlled by fulguration of the cut surface immediately after the punches were made The suprapubic wound following this quickly closed and by February 1918 there was complete control of urination No difficulties Nicturia of 1 to 3 Bladder capacity 20 cubic centimeters with no residual and the urine practically clear The patient was seen in January 1919 He has complete control of urination Nicturia none to one urine clear cured

CASE 4 Male age 55 I.C. No. 3 Referred by Dr. A. W. Weaver Stanford University The patient constant desire to urinate which is accomplished after much straining The stream is very small and at times almost a dribble The urine is cloudy with pus

The patient has at times had excellent health Numerous diseases and no history of nephritis

About one year ago he fell asleep after which he had complete retention and as catheterized for the next 20 to 25 days He has never voided normally since this accident Frequency and difficulty have been gradually growing worse

General examination as negative Wassermann negative The urine purulent with a few many colonies of bacilli no casts Lethal in 30 minutes catheter March 13 30 minutes 30-1

Rectal examination Prostate is small and elastic with the usual are slightly indurated Section shows 80 per cent pus

Cystoscopic examination Bladder capacity 60 cubic centimeters Residual 600 cubic centimeters No urethral strictures There are no intravesical prostatic hypertrophy but a very definite median bar posteriorly To the outside of each lateral inflexure there is marked trabeculation and numerous celluloses and posteriorly in the lower part of the fundus is seen a perfectly rounded black opening about 5 centimeters in diameter which is so firm back that it is not possible to insert the cystoscope into it

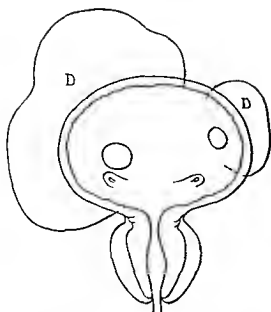


Fig 6 Diagram of condition in Case 3. Large diverticulum opening into the bladder just above the right ureteral meatus and smaller diverticulum with its orifice farther above but definitely in the neighborhood of the left ureteral meatus.

region. The bladder capacity is 140 cubic centimeter, no residual. Urination is still frequent. The patient has been at work in a machinery warehouse for several months. He was last seen March 1, 1910. He has not lost a day's work since last note. The urine has been clear for several months and he has had no chills, sweats or fever for many months. He voids freely with complete control. Still nocturia 1 to 3. This is a most remarkable recovery of bladder function.

CASE 6. Male, age 34, I.C. No. 338. Referred by Dr. June Harris, Sacramento, California. The patient complains of headache and dizziness frequently and burning upon urination, pain in the lumbar region, marked pyuria and occasional

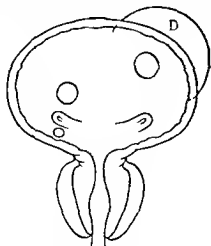


Fig 8 Diagram of condition in Case 4. Large diverticulum opening into the bladder just above the right ureteral meatus and smaller diverticulum with its orifice farther above but definitely in the neighborhood of the left ureteral meatus.



Fig 7 Photograph of the diverticula removed in Case 3 (see Table II).

hematuria. His health has been good except for malaria at 14 and neisserian infection at 20.

The first evidence of present trouble was noticed about 5 years ago when he was refused for insurance on account of pyuria. He had passed an examination, 3 years previously. Very soon afterward he began to have headaches and frequency and burning upon urination and these symptoms have gradually increased in severity until during the last 6 months he has voided every 10 to 30 minutes and at some period during each 24 hours has passed blood. The patient has had pain in the lumbar region off and on for the last 10 years and admits that he has had some difficulty on urination for many years with infrequent periods of frequency.

General examination is negative. Wassermann 1 negative. Blood pressure 148-90. Urine is very cloudy with pus, no casts, numerous red blood



Fig 9 Photograph of the diverticulum removed in Case 4. Perforated and shrunken (see Table II).



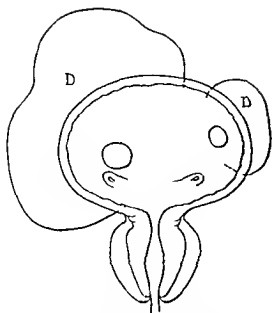


Fig 6 Diagram of conditions in Case 3. Large diverticulum opening into the bladder just above the right ureteral meatus and smaller diverticulum with its orifice farther above but definitely in the neighborhood of the left ureteral meatus.

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CASE 6. Male age 34. I. C. No. 558. Referred by Dr. June Harris, Sacramento, California. The patient complains of headache and dizziness, frequency and burning upon urination, pain in the lumbar region, marked pyuria and occasional

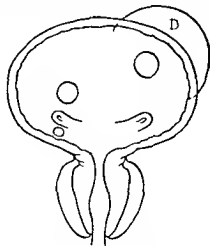


Fig 8 Diagram of conditions in Case 4. Large diverticulum posteriorly with its orifice above the left meatus. Cells above and below the right ureteral meatus.



Fig 7 Photograph of the two diverticula removed in Case 3 (see Table II).

hematuria. His health has been good except for malaria at 14 and gonorrheal infection at 20.

The first evidence of present trouble was noticed about 5 years ago when he was refused for insurance on account of pyuria. He had passed an examination 7 years previously. Very soon afterward he began to have headaches and frequency and burning upon urination and these symptoms have gradually increased in severity until during the last 6 months he has voided every 20 to 30 minutes and at some periods during each 4 hours has passed blood. The patient has had pain in the lumbar region off and on for the last 10 years and admits that he has had some difficulty on urination for many years with infrequent periods of frequency.

General examination is negative. Wassermann is negative. Blood pressure 148-90. Urine is very cloudy with pus, no casts, numerous red blood



Fig 9 Photograph of diverticulum removed in Case 4. Preserved in formalin and shrunken (see Table II).



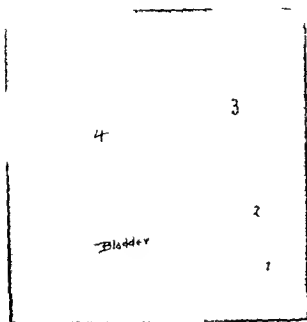


Fig 1. Cystogram. 1. Bladder. 2. Vagina. 3. Uterus. 4. Rectum.

cell many stercoraceous contents. The uterus is not anteroposteriorly enlarged. The right adnexum is small and indurated. The left adnexum is marked.

Cysto-photography. Bladder capacity 600 cubic centimeters. Residual 350 cubic centimeters. There is no intravesical prostatic hypertrophy, but a definite contracture of the neck. The orifice of the ureters is distinct. The ureters are not above the respective ureters into the neck of which could the stone be inserted. The bladder posteriorly is abnormally thickened. The cystogram shows the ureters and the bladder.



Fig 2. Cystogram. 1. Normal bladder. 2. Contracted bladder.

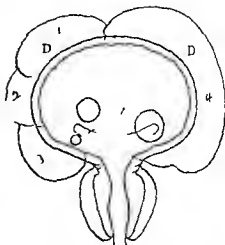


Fig 3. Cystogram. 1. Bladder. 2. Uterus. 3. Vagina. 4. Rectum.

Figure 14 and 15 are cystograms. Figure 15 is a diagram of the bladder and uterus.

Operation. A suprapubic incision was made above and near the respective ureters. The left one was about two-thirds of an inch long. The right one was about one and a half inches long. The stones were removed by the method of Young. There is a marked contraction of the bladder.

Postoperative course. The patient was discharged on March 2. The bladder capacity was 15 cubic centimeters. The residual was 30 cubic centimeters. The bladder is not contracted. There is no evidence of median bar or contracture.

He is well at present. The bladder capacity is 15 cubic centimeters. The residual is 30 cubic centimeters. The bladder is not contracted. There is no evidence of median bar or contracture.

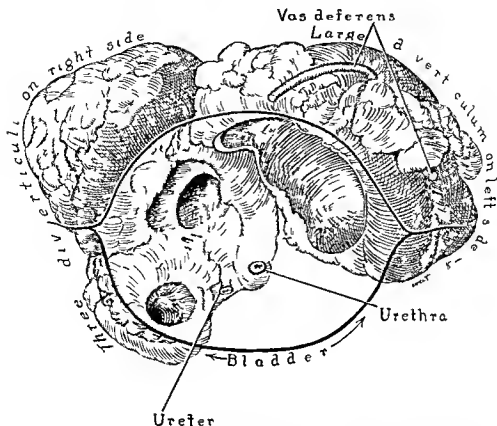


FIG. 3. Diagram of four diverticula removed in Case 5 to show relationship to ureteral orifices. The left vas deferens was sacrificed in the removal of the left sac which extended deeply posteriorly and in the attempt to free and preserve the left ureter. The cut end of the right ureter is shown hanging from the lower portion of the specimen.

from the patient in September 1918 states that he has completely recovered voids normally and without difficulty and has no nycturia. The urine is clear. The patient was seen December 6, 1918 and was perfectly well. There was no nycturia. The urine was slightly cloudy, no residual. Prostatic secretion shows 80 per cent pus and diminution in lecithin.

**CASE.** Male, age 46, P. C. No. 438. Referred by Dr. T. J. Cox, Sacramento, California. The patient complains of burning and urgency and pain on urination. Nycturia 5 to 10. He is very nervous, sleeps poorly, and has constant dull ache in the lumbar region radiating out to the thighs. He also had pain in the arms, legs, neck, and shoulders and suprapubic discomfort.

His general health has never been good. He has had lumbar neuralgia for years. He was operated on in 1911 for gall bladder infection. Polyps were removed from the nose three years ago. He has had much stomach trouble. He gives a strong alcoholic history. Chancere 30 years ago. Treatment for 2 years. Neisseria infection 8 years ago and several attacks since.

The patient states that he has had light burning and urgency with nycturia 2 to 3 all his life. There has been slight difficulty in starting stream but never any retention or hematuria.

General examination negative. Repeated Wassermanns during the last 4 or 5 years have all been negative. Spinal puncture April 30, 1918 shows negative Nonne and Noguchi. No increased cell count. Spinal fluid Wassermann negative. Blood pressure 110-75. Phthalein 10 minutes 30-20. Urine shows shreds in glass 1 and a few pus cells microscopically in glass 2, faint trace of albumin. Rectal examination: prostate is slightly enlarged, uniformly indurated with definite adhesions laterally. Seminal vesicles slightly indurated with marked intravescicle thickening. Secretion shows 90 per cent pus. No lecithin, no spermatozoa.

**Cystoscopic examination.** Bladder capacity 460 cubic centimeters, residual 100 cubic centimeters. Inspection of the vesical neck shows no sulci or intravescicle hypertrophy. There is a slight median bar and the interureteral ridge is raised and hypertrophied. Upon the left side about 3 centimeters above the left ureter is seen the mouth of a diverticulum. There is slight trabeculation and cellulose formation in the region of the right ureter.

**Diagnosis.** Pronounced chronic prostatoseminal vesiculitis, contracture of the vesical neck, diverticulum of the bladder. Cystogram shows a large pouch on the left side illustrated in Figure 18.

**Operation.** August 6. Suprapubic extraperitoneal excision. The specimen removed is shown in

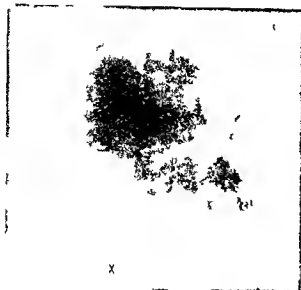


Fig 4 Cystic mass (left) and (right) thick  
The trabeculae of the left and right  
happened to be the same

Figure 5 The patient had a not p t l  
on except for the rough left t n (cell) on  
right too small to limit get up

Co al scene a ue if l h patient l h  
fo C lary B C sh t l f t leaving the hospital  
n l sub sequent e am in tion h a t b n m l a  
t H tes that h i mu h m p r o l t h t h e  
b ame perf lly ell l t t h t h r m o t h g o  
had influ nza s i c e h h h e l s n t e d m  
hesitancy frequ v and light d i l u t y o n u  
tion prof lly lu tore on t r u r f v e c l n k  
No r idu l urine clea e c p t l r h l l o  
t t i sec t o n o p e c n t p u s

CASE 8 Male 51 l C No 83 l cferred  
by Lt Comm n l r Fatt l U S N March 11 nd  
Na v Ho p t al Th p t n t complain of  
t u r i a  
to 3 Th re is pa n th left lumbar on rad t  
i g to the groi H u s s e from n ous n and  
nsom ia

His health has l v been go l Ne s r u n  
infection at 3

In 1904 th put ent fell on shipboard d was  
ll fo 2 month th pain n the l ft lumbar region  
In 1916 he ag in had a fall of 40 feet on a h board  
and had a re ur ren e of pain the left lumbar g n  
hich disabled him for 3 eeks Since th last  
njury he has never been cll havin recur nt p ns  
n the left side 7 day ago he l pped do n  
ladde l n d i g n his left fo t c using a recur  
rence of the left lumbar pu There has be n no  
particular urina y lusto v No difficulty or fre  
quency

General examination negative Wassermann  
negati e U n s n gati e Phthal in o m m  
utes 45 5 Ureteral catheteri at n double  
pvelography with complete X ray studies of kid



Fig 5 C t t c y t m f Ca 6 Th t d e  
t l b u t f lly d m t r a t d l y b e h d t h  
t l t g t l l t l d b l d d r N l a g e

neys and l r t r negative Wa tip xplor o  
n at for u e t r l s t e X ray of spine n e a  
t Rect l e am in at o n P o t r a t e n o t e l a r g e d  
l r r o d d notch are ell m r k e d Secret on i  
n g t e

Cysto p i l Th bladder capacity  
s 480 cub c ntimeter idu l o b e c e  
t m e t r s N o i n t i s l h y p e t r o p h y Th bladder  
slight t a l e c u l a t e d p r t u l r l y n a r the uret e al  
o r f i c u t h s i e e l l u l f r m a t i o n A b o u t  
c n t u m t e b the right u e t e r the orifice of  
a l a r g d e r t i c u l u m C y t o g a m i l l u t a t e d n  
Figure 9

Ope n n 1 s t 9 S prapub e trapento cal  
ex on of l v e r t c u l u m D e p c e l l u l e i n l e f t u r e t e r

Conv l e c c n e u n e v e n t u l T h e b l a d d e r  
c l o s d p e p u r A l e t t e f m t h p a t i e n t  
October 9 1908 t a t e s t h t h e h s r e m e d p e  
f e c t l y e l l and has h d no recur n e of h s lumbar  
pain and does not no get up at ght to urinate  
I a m i n t i o n t M a r e I s l a n d H o p i t a l a f e d a y s  
b e f r e d c h a r g e s h o e d b l a d d e r c a p a c i t y 4 0 c u b c  
c e n t i m e t e r and 80 cub c centimeters re idual  
F a m i n t i o n N o e m b r i 1908 h o w 75 cub c  
c e n t i m e t e r s r e d u r d p a t i e n t t i l l c o m p l a i n s f  
s u p r a p u b l i s c m f o t n d o m s l i g h t d i f f i c u l t y i n  
u n a t i o n X u g s p n c h o p e r a t i o n f o r c n t r a c t u r e  
a t n e c k p e r f o m e d a t U n i e r s i t y of C a l f o r n i a H o  
p i t a l J a n u a r y 1910 The p t n t a s e e n o

March 1 at which time there was no residual no nycturia the urine was clear and he voided freely and normally.

CASE 9 Male age 6 P C No 838 Referred by Dr J N Toner. The patient complains that he has no control of urination he has almost constant dribbling and wears a urinary.

He had typhoid at 3 pneumonia at 33 and a merian infection at 35. Lues denied.

For several years the patient has had some frequency of urination and slight difficulty. About 3 years ago he had sudden complete retention for which he was catheterized. There was some relief for a few months when he was advised to have an operation which was done in September 1911 through the perineum. Subsequent events lead one to suspect that no prostatic enlargement was found. The condition was not relieved but was very much aggravated frequently every 15 to 30 minutes with continuous urgency. For several months there has been incontinence.

On the right side below the umbilicus a rounded mass palpable which disappears after catheterization. Right epididymis enlarged the size of a goose egg.

Wasermann negative. Phthalein September 9 10 minutes 3-5 September 13 (after the use of a retention catheter) 10 minutes 30-25. Urine shows abundant pus much albumin no sugar no casts. Rectal examination hemorrhoid present. Prostate was found to be enlarged and indurated. Erection shows 50 per cent pus. The enlargement is confined to left side only and was considered to be a large left lobe overlooked at previous operation.

**Cystoscopic examination.** The bladder capacity was 300 cubic centimeters. There was complete retention. Large left sided intravesical prostatic enlargement (which operation disproved). The bladder wall is trabeculated and the orifices of numerous pouches and cellules are visible. The left ureter could not be found and apparently opened behind the intravesical lobe (found at operation to be a dilated diverticulum). Above the right ureter the mouth of a large diverticulum. Posteriorly above the trigone are the orifices of 2 other diverticula numerous deep cellules posteriorly and in the region of the right ureter.

Recto-urethral examination shows apparent thickening on left side and a definite median bar over which the beak of the instrument is felt to ride. Cystogram shows diverticula as illustrated in Figure 20 and their relation hip to the bladder and ureters as illustrated in Figure 1.

**Operation August 19.** Suprapubic extraperitoneal excision of 3 diverticula. The orifice of the fourth diverticulum noted on cystoscopy to the midline posteriorly admits the tip of the index finger for about 1.5 centimeters and was not thought sufficiently large to justify removal. The left ureter opened into the largest diverticulum on the left side and was transplanted to the mid-

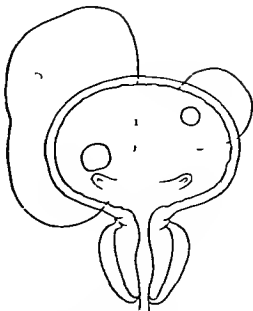


FIG. 16. Diagram of condition in Case 6. At operation one of the ureters had to be transplanted.

portion of the bladder posteriorly. The vesical neck was widely dilated and divided with a cautery. Specimens removed are shown in the photograph. Fig. 17. For the first few days following operation the patient's condition was not satisfactory. On the 23rd he developed signs of pneumonia with consolidation of the right apex and fluid at the right base which was tapped at the eighth interpace and about 10 cubic centimeters of clear straw-colored fluid obtained. Since then improvement has been steady. The patient is walking about although still in the hospital and the suprapubic fistula is still draining. On December 1, 1918, the suprapubic fistula closed for a few days but reopened.

**Second operation February 19, 1919.** The bladder capacity is 130 cubic centimeter. The patient dribbles and is unable to empty his bladder. The suprapubic fistula is still open about half of urine draining through it. Nitrous oxide oxygen anesthesia. The fistula was resected down to the bladder. Exploration of neck showed tight fibrous circular contracture which was divided by Young's punch *per urethram* guided by suprapubic control. Bladder closed tightly. Coude catheter in urethra.

On March the condition was satisfactory. The urethral catheter was still in place attached to Davis suction bottle.

On March 6th suprapubic wound was healed and has been perfectly dry for three days.

On March 1st suprapubic wound healed. There is only partial control of urination probably due to disturbance of external sphincter at time of prostatectomy.

CASE 10 Male age 3. There is marked frequency with inability completely to empty the bladder burning at beginning of urination pyuria. The patient had a merian infection when 3.















Fig. 25. Cystogram of Case 1. A definite diagnosis of diverticulum could not be made from this picture alone.

apparently of diverticula can be seen. Two of these are near the regions of the right and left ureters respectively. One is 3 or 4 centimeters above the right ureter and is best seen in the right lateral far position of the cystoscope. The fourth is a narrow rather oblong shaped orifice on the right side toward the middle of the posterior wall. Recto-urethral examination shows definite thickening between the finger and the shaft of the instrument the bulk of which cannot be definitely felt.

Plain X-ray pictures show stone shadows in the bladder. Pain and frequency of urination following cystoscopy were quite marked and on April 25 under local anesthesia a suprapubic cystotomy was performed and three stones were removed. The patient gradually improved under suprapubic drainage and on May 21 a suprapubic prostatectomy was performed. At the time of the operation the diverticula were located with the examining finger and the two in the region of the ureters were found to be quite deep, the one of the left side being the largest and was seen to extend well down between the rectum and the prostate. The two pouches on the right side were not far distant from the ureteral orifice and were apparently small and with very thin walls. Owing to the patient's generally poor condition the diverticula were not resected, this being left for a future operation if found necessary. The lateral and middle lobe were removed in one piece



Fig. 26. Cystogram of a case in a man aged 64 with a marked contracture of the vesical neck. He was operated upon suprapubically. Cystoscopically no diverticulum could be found and careful exploration of the bladder at the time of operation revealed none. The man had an uneventful recovery and is well. The cystogram is shown in order to illustrate the value of contrast picture and also the tremendous effect on the ureter and bladder of back pressure from simple contracture of the vesical neck.

each of the same size approximately 2 by 3 centimeters.

Convalescence was uneventful. The suprapubic fistula quickly closed. The patient voided normally through the urethra although the urine still remained purulent. He was discharged June 22 to return for observation. The patient has not been seen since leaving the hospital.

CASE 19. Male age 69. U. C. H. No. 2683. The patient complains of frequent painful urination and continuous dull backache. He had a gonorrheal infection at 41. The patient's history is otherwise irrelevant.

For more than 15 years the patient has been troubled with painful and frequent urination which has been more or less intermittent. The pain is referred to the neck of the bladder and is most marked at the beginning and end of urination. He has thought he had milky urine at certain times. He has also noted that the stream will sometimes stop almost completely and will start again in a few moments. Recently there has been difficulty in starting and the force is diminished. There has been



several months has been confined to her bed almost continuously

General examination is negative. The uterus is in good position and there is no cystocele, no caruncle, polyps of the urethra or other abnormalities. The urine is very foul and purulent and contains an occasional cast. Ithalein first hour 10 per cent second hour 15 per cent.

Cystoscopic examination shows a markedly trabeculated bladder simulating in every way the bladder seen in men with contracture at the neck or prostatic hypertrophy. The bladder capacity is about 620 cubic centimeters, residual 310 cubic centimeters. Numerous deep cellules are located about the orifices of both ureters and on each side the black mouths of deep diverticula are seen. Cystoscopic study indicated that there were four definite diverticula. Unfortunately a cystogram was not made. The patient has moved to Los Angeles so that further study has not been possible.

#### SUMMARY OF ANALYSIS OF 1 CASES

A vesical diverticulum is not a rare finding in urologic practice. It occurs most frequently in men over 50 years, the average age being 56, youngest 37, oldest 77. It is very exceptional in women (cases ages 40 and 56) and in this series no instance has been seen in children.

The diagnosis is made definitely by careful cystoscopic and cystographic study. Cystography is more accurate when both plain and contrast pictures are taken. The cystoscope is unreliable for accurate determination of the size and position, and the simple cystogram may fail to show even a large diverticulum. Properly used in conjunction the three methods give reliable information.

In 17 operations in which the number and relative position of the diverticula were determined by direct examination, a single large diverticulum was present in 11 cases, two large diverticula in 4 cases, and three and four large diverticula each in 1 case. In every case of single sacculization the orifice was located in the neighborhood of an ureteral orifice. In the cases with two diverticula there was usually one each near the respective ureteral meatus. The base showed a diverticulum only when the neighborhood of the ureteral orifices had diverticula, and in these instances the diverticulum at the base was always the smallest. In not one case of the 17 operations was the region of one or the other ureteral orifice uninvolved.

The base and posterior walls of the bladder were markedly trabeculated in every case. Large cellules easily admitting the tip of the gloved index finger were located in the neighborhood of the opposite ureter in 9 of the 11 cases of single diverticulum and in the base of the bladder in 3 of 5 instances of multiple diverticula. In no instance was the mouth of the diverticulum or the cellule found on the high lateral or anterior walls of the bladder. The ureter was shown by the cystogram to be markedly dilated on the right in three cases and on the left in two; both ureters were dilated in one case.

The walls of the diverticula removed at operation vary in thickness from  $\frac{1}{4}$  millimeter to  $\frac{1}{2}$  centimeter, and this variation in thickness exists for different portions of the wall of the same diverticulum, even the thickest having some extremely thin and transparent areas. There is a remarkable absence of epithelial lining to the diverticula, which may be the result of surgical trauma. In the one case which showed a lining it was a thin pavement epithelium unlike bladder mucosa. The inner surface of all sacs showed a chronic inflammatory reaction.

The muscle of the walls showed no definite arrangement into layers in any way analogous to the vesical muscularis, but invariably occurred in sparse or heavy bands scattered in more or less dense connective tissue. In some of the walls these bands by their transverse or longitudinal course indicated an imperfect circular or longitudinal layer.

A contracture of the vesical neck was found in association in 13 cases and received surgical treatment in 8. A small fibrous or ring prostatic hypertrophy was removed suprapubically in three cases and perineally once. A large glandular prostatic hypertrophy complicated two cases. The diverticula in all of these six cases associated with prostatic enlargement were relatively small and were untreated surgically in three cases, in the two large glandular and in one fibrous hypertrophy. In the two cases in women which have not come to operation no definite obstruction to urination other than that attributable to the diverticula was found.

An analysis of symptoms disqualifies vesical

diverticulum as a distinct clinical entity. The onset, course and termination duplicate the clinical picture of prostaticism. With respect to urination the onset symptom was difficulty in 14 (with frequency in 7 with urgency in 4 with hesitancy once and simple difficult urination twice) complete retention occurred at the onset in 3 cases, 14 of which had contractures of the neck, and the other 1

small fibrous hypertrophy. Diminution in the urinary force, pyuria, pain in the lumbar region and pain in the right side were the respective initial symptoms in four cases. Cloudy urine was first noticed on an average of 6 years and was absent altogether in 3 cases, whereas the average duration of symptoms since onset is 16 years. Vesical calculus complicated the anomaly only once.

## PRECANCY AND LABOR FOLLOWING AMPUTATION OF CERVIX UTERI

BY O. S. FAWCETT, M.D., CHICAGO  
A. I. G. COL. W. L. Y. M. M. H. F. C.

COMPLIANCE with amputation of the cervix uteri by the Schroeder method has been performed with great frequency since 1878, but the effect of the operation upon subsequent gestation and labor has produced hitherto only an unimportant literature. Leonard alone has given the subject the dignity and importance it seems to deserve.

Whether this dearth is due to inattention or to oversight it is difficult to say. It can hardly be owing to a lack of complications in these cases. What literature we have abundantly indicates the gravity of the association.

To be sure LaFarre believes that pregnancy and labor is undisturbed and Marisani thinks it would be undisturbed if the operation was well done, and if there was no subsequent suppuration, but the question has never been authoritatively decided.

Authors are to be found in the literature however in sufficient numbers who were not so favorably impressed with the operation as to let the question go undiscussed. Thus Cuzzi and Jesinelli report four cases of which only two went to term and Gottschalk observed frequent instances of abortion and premature labor. Audibert report sixteen cases of which only five went to term and the various interruptions were characterized by much hemorrhage and more than the usual proportion of abnormalities. In his collection he found ten vertex two breech and three

shoulder presentations which required four artificial extractions and the series resulted in a total fatal mortality of 20 per cent.

It is only fair to state however that the consequences in the opinion of Pözl, LaFarre, Marisani and others are regarded as evidences of bad technique.

Modern gynecologists are all so seriously divided on the question which nevertheless has received relatively little attention. Lynch is inclined to be optimistic and Goldstone informs us that in his one case the labor was almost precipitate and for this reason he thinks the unfavorable attitude hardly warranted.

For the most part however the current of authoritative opinion runs rather contrary to the operation in child-bearing women.

Thus Peter on of Ann Arbor reports a case in which the amputation was followed by a prolapse and pregnancy and labor supervened. After eighteen hours of relatively hard pains a vaginal cesarean section was done followed by version and extraction.

Edgar in a personal communication says that he always dreads such labors for fear into the broad ligament are imminent. He believes that the operation should not be done where subsequent pregnancy is probable but given such a case he advocates the cesarean operation.

J. Whitridge Williams regards the operation as the most frequent cause of premature labor with which he is acquainted, even

detention in bed being insufficient to prevent the disaster. In other cases he states that the scar is productive of prolonged and difficult dilatation which frequently necessitates artificial assistance and results in severe labors in women who have had easy labors previously.

In other cases Williams found such complete cervical atresia that while the entrance of spermatozoa had been possible no trace of a cervix could be found at term and caesarean section was imperative.

E. P. Davis mentions one case in which premature labor developed and artificial dilatation was necessary. In another case after long delay in the first stage the labor was terminated by manual dilatation and forceps. In two other cases caesarean section was the only means of evading the difficulties presented by the mass of cicatricial tissue. He is of the opinion that the complete amputation of the cervix is an undesirable operation during the child bearing period as a normal labor subsequently is quite exceptional.

Newell of Boston feels that while the scar tissue may soften up and delivery occur yet in many instances the cicatricial ring is an insuperable obstacle to delivery. He also suggests that these cases should be sterilized if the complete amputation is done and if the woman should go to term the caesarean operation is advisable.

With these quotations which freely illustrate the seriousness in which the operation is held and the variety of complications which it may furnish during pregnancy and labor we take the opportunity of reporting a case which came into the service of Reed at Wesley Memorial Hospital.

Patient III para age 35. Pelvic measurements were Sp 21 Cr 26 Ext C 16 plus.

First pregnancy miscarried at three months second went six weeks over the calculated time and after three days of labor pnhotomy was done and a 12 pound child extracted that lived 24 hours. The patient had a complete tear of the perineum. Six months later the Schroeder operation was done on the much mutilated cervix.

The patient came into Dr. Reed's service in the fourth month of her third pregnancy. The cervical scar was a hard inelastic ring which at no time softened. Fearing the patient might go into labor with disastrous consequences a caesarean section

was performed about two weeks before the calculated maturity of the child and on January 23, 1918 a six and one half pound male babe was delivered. The classical operation was done and the patient was sterilized by resection of the tubes before the abdomen was closed. Both mother and child made uneventful recoveries.

My own case which aborted had the following history.

Mrs. S. age 25 married 6 years had a difficult forceps delivery 18 months after marriage. She had a miscarriage a year later at three months. Shortly afterward an amputation of a badly lacerated cervix was done. Since the operation she has had three miscarriages at six and one half four and three months respectively.

I saw her in the third month of her sixth pregnancy. She complained of pain and bleeding. Two days later she miscarried. At present she is again about two months pregnant. She refuses to be sterilized.

The gynecological aspect of the question has been well covered by Leonard in his excellent report of the Johns Hopkins cases published in 1913 in which he includes the statistics after operations. In all one hundred and twenty eight cases are analyzed. We have carefully revised his bibliography and can find no valid reason for going back of his paper again. It is complete to the date.

In women who are approaching the climacteric there can be no question as to the value of this procedure but should the operation be done on patients who are liable to conception? This is the question which seems to need further discussion.

Happily sterility is not uncommon after the cervical amputation for according to Leonard less than 20 per cent are found to conceive. This is owing to cicatricial contraction stenosis of the os and possible other changes.

Leonard goes on to show how by Kelly's technique these conditions may be avoided but it seems to the writer that whenever the operation is done sterility should be definitely assured by an intentional technique. This opinion is based first on the frequency of abortion which is admittedly about 50 per cent (Leonard) and more particularly on the dystocia in which the case will probably terminate.

In this connection the cases reported in the

early years of the operation cannot be considered for the stump was allowed to heal by granulation and the results were not ideal but since then the repair work has been carried out more carefully with aseptic precautions and good technique but the operation still shows so large a proportion of hazardous labors as to make one hesitate to employ it during the child bearing period.

The scar tissue must produce physiologically a certain amount of contraction under the most favorable circumstances and the ring of the new cervix is necessarily less elastic and more liable to laceration when the child passes. Such laceration is in no way under control and may easily extend into the broad ligament.

Pinard Guibont Martin Pescher Tarnier and many others concur as to seriousness of the obstetrical mishaps which may attend such a delivery and indicate the frequent necessity for cesarean section.

In Leonard's own series of fourteen cases 11 or 64 per cent had serious dystocia while only four had easy labors.

The whole question turns more or less on the functional importance of the cervix. The value of the cervix to a pregnant or laboring woman seems to have found few investigators in literature in spite of the vast mass of discussion which developed regarding Bandl's ring and the lower uterine segment.

Whether or not the cervix becomes a part of the lower uterine segment is not the province of this paper to set forth. Ablermen have spent an enormous industry thereon. But one point at all events seems clear. The cervix acts as does a puckering string to a bag or as a stopper to a bottle so far as it relates to the gestating uterus and its removal

subjects the patient to the theoretical and as the cases seem to show to an actual danger of uterine evacuation at all stages of pregnancy. The danger of premature delivery which affects at least 50 per cent of the cases as statistics show and as authorities agree is seriously added to by those tissue changes which inevitably take place in the amputation stump.

Studdiford having in mind the complications to labor which we have cited recommends as a routine that amputation should never extend higher than one half inch below the internal os in order to anticipate the alterations such as marked shrinkage of the entire uterus which interferes with the power of the organ to complete its functional cycle. It therefore excludes the true Schroeder technique.

But even with this modification it seems to the writer that Leonard's conclusion must be fully endorsed namely that serious dystocia will commonly arise from the cicatricial rigidity that follows the operation and that the operation should not be performed on women during the child bearing period unless more conservative measures have failed and further if the operation should be done during the child bearing period the patient should at the same time be sterilized.

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## OCCURRENCE OF NEW-GROWTHS IN THE ABDOMINAL WALL AFTER LAPAROTOMY<sup>1</sup>

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**I**N 1916 Balfour reported seven cases of desmoid tumors which had occurred in the Mayo Clinic. Of these two had occurred in laparotomy scars and after a careful review of the literature he was not able to find any other cases which had followed operation. A review of the literature to date has brought to light no reports of similar cases in American literature and none in such European reports as are available unless two very inadequately reported cases, one in the French and one in the German, should belong to this class of growths. In the past year two new growths in laparotomy scars have occurred in my own experience, one being a true desmoid and the other a fibrosarcoma. One of these was a private patient and the other occurred in my hospital service. The cases are as follows:

**CASE 1.** Widow, age 40, had undergone appendectomy in 1911 and abdominal hysterectomy in 1915 by a surgeon in the South. Several months before entering the hospital here she had noticed a swelling at the right side of the lower end of the median abdominal scar. This had been slowly growing, moderately tender to pressure but not painful. Upon examination the mass was firm, only slightly movable, not adherent to the skin and gave no impulse upon coughing. Upon operation a mass 5 by 4 by 3 centimeters, irregular in shape, apparently arising from the fascia of the abdominal wall, was excised. The underlying portion of the fascia was also removed. The peritoneum was opened and the abdomen found to be completely negative. The pelvis was in excellent condition, free from any adhesions, gall bladder negative. Upon microscopic section the mass showed distinct evidences of fibrosarcoma, being composed almost conclusively of spindle-shaped cells with very distinct nuclei closely associated with polymity but little disturbed. She was then given intensive X-ray treatment during her stay in the hospital. A few months later she informed me by letter that a growth was reappearing and that she was undergoing X-ray treatments in the medical department of a Western University. She subsequently returned to me at which time a mass 15 centimeters in diameter, hemispherical, red and fluctuating on the top, was found in the lower half of the abdominal wound and she shortly after entered the Cook County

Hospital where she came under the care of John A. Weller to whose courtesy I owe the report of the operative findings at that time. He found a tumor soft, broken down in the middle, densely adherent to the abdominal wall, requiring resection of the fascia and a portion of the fundus of the bladder. The pathologist at that institution however pronounced it to be non-malignant.

**CASE 2.** The patient, age 24, single, had had six years previously a median laparotomy at which time the appendix only had been removed. The pelvis at that time was said to be normal. This patient presented a mass in the lower third of the scar, easily felt under the skin, hard, tender, only slightly movable. Incision was made through the old scar and an irregular, spherical, hard mass about centimeters in diameter was excised with its fascial attachment. The abdominal wound was opened. No adhesions to the side of the old wound were present. The uterus was normal in size and position but a right ovarian cyst, about 10 centimeters in diameter, was found and excised. The abdominal mass on microscopic examination was found to consist of hard fibrous tissue arranged in bundles, the fibers in many areas giving a wavy effect, the typical microscopic picture of desmoid. The ovarian cyst contained a non-malignant papilloma.

Of the seven cases which Balfour reported two only had occurred in laparotomy wounds. The second of the two cases noted above being a true desmoid tumor should I think be added to the two contained in Balfour's report. Tavernier and Chaher give a brief report of a growth in the scar of an old gastro-enterostomy wound, the mass being hard, white and apparently cartilaginous in character. No histological findings are given in this report.

Pollosson reported a case of a growth which had occurred in a woman, aged 59, upon whom a difficult hysterectomy had been carried out, there being a neoplasm of the uterine body. The character of the neoplasm was not definitely stated. Four years after operation a large abdominal tumor had appeared, extending below as far as the pubes, over which it had pushed slightly and extended laterally for about 3 centimeters on each side. It was 5 to 6 centimeters in depth and had lost all



lateral mobility. The skin was reddened at one area and the tumor was apparently softened at that point. Extirpation was done. The bladder was injured but the patient made a good recovery.

The author gives no details as to its histological character and one can therefore not say whether this belongs to the relatively benign class of desmoids or whether it was a tumor of malignant character.

Fibrous tumors of the abdominal wall are not at all uncommon as a report appeared in 1904 by Pfeiffer showing a collection of more than 400. Their etiology like that of other tumors is not altogether clear. Pregnancy however seems to be a definite predisposing factor inasmuch as in the majority of individuals in whom they are found pregnancy has occurred.

As to sex as Balfour points out they occur in women in the ratio of 7 to 1. It is possible that the stretching of the abdominal wall incident to pregnancy together with the possible tearing or rupture of some fibers in the aponeurosis of the rectus and oblique muscles may furnish the trauma necessary to the starting of a new growth.

The difference of the susceptibility of the peritoneum in different individual and its influence upon the subsequent production of adhesions has long been noted. It is possible that there may be similar variations in the susceptibility of aponeurotic tissues in different individuals.

Saxon and Corwin White in a study of tumor formation in both plant and animal life call attention to the condition experimentally produced by L. Loeb in guinea pigs. He found that if an incision were made into the uterus of a guinea pig in certain early stages of pregnancy there would be formed nodules having the structure of decidua. He made transverse and longitudinal cuts in the uteri of anesthetized animals. The nodules were due to a proliferation of interglandular connective tissue of the mucosa. The tumors grew rapidly until about the thirteenth day and then quickly disappeared. While these growths were produced only in pregnancy and were evidently due largely to its presence still as they were composed

of connective tissue and appeared after a wound of the uterine wall it would seem that a moderate trauma bore a definite relationship to their appearance. The pregnancy itself however is not supposed to have any relation to the appearance of desmoids except as the source of a possible trauma provoking possible slight injuries of the aponeurotic structures.

The diagnosis of these tumors is as a rule not difficult. The most careful discussion of diagnosis is given by Pagenstecher. They occur most frequently in the sheath of the rectus and upon the aponeurosis of the oblique muscles. They are usually irregularly round with rather sharply defined borders and when being grasped are not movable upon the underlying tissue. Upon being forcibly moved the underlying abdominal wall moves with them. The most characteristic point is that when the abdominal wall is under tension they disappear while when it is relaxed they become easily noticeable. They are ordinarily small but have been noted as large as the size of the foetal head.

They must be distinguished from sarcoma, hernias of the muscle, lipomata and from inflammatory growths in scars following laparotomies. The differentiation from all of these should however as a rule not be difficult. Pagenstecher includes what he calls Schloffer's tumor among the growths which should be differentiated from desmoid growths. This is a chronic inflammatory process described in 1908 and was found to follow hernia operations. Schloffer reported four cases of this type all after herniotomies.

The time between the operation and the appearance of the tumors had varied from some months to five and one half years. The growth of this lesion is always slow and usually not accompanied by any functional sign. These tumors are usually globular or ovoid with a smooth irregular surface. They are subcutaneous and the skin over them shows no signs of edema. Upon incision one finds in the center of the growth a small abscess in which a piece of silk suture is embedded. After the removal of this the growth disappears spontaneously. As silk sutures in laparotomies and herniotomies are in the

country practically never used this growth is undoubtedly one which would not be seen here hence would scarcely enter into our differentiation

Upon diagnosis treatment is quite clear. The mass should be excised immediately. The excision should include the removal of that portion of the aponeurosis which forms the base of the tumor. This occasionally means that a considerable area of the underlying aponeurosis must be sacrificed. In case so much is removed that closure is rendered difficult closure with transplantation of fascia ordinarily taken from the fascia lata must be considered. Excision of this growth should be followed by careful microscopic investigation in order that the occasional

occurrence of malignant growths such as the one contained in this report may not be overlooked

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### THREE NEW AMPUTATIONS OF THE FOOT DESIGNED TO RETAIN THE CALCANEAL TREAD

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**T**IBIOTARSAL and transtarsal amputations have always provided material for thought and discussion among surgeons. But it appears to be agreed that if they are to be done at all it is very important that the stumps of such amputations should always be provided with good weight bearing ends.

In October 1914 I had to deal with a hopelessly crushed foot when it occurred to me to shear away part of the under surface of the talus and the upper part of the calcaneus and to fit then the two plane surfaces in apposition after removing the projecting greater process of the calcaneus. The result was in every way excellent and it remains so to this day. Shortly afterward I had a similar problem to solve after a traumatic gangrene of the anterior part of the foot. I performed a very similar operation with an equally satisfactory result. Space forbids here a detailed account of these two cases but I hope to be able to describe them at length in another paper which will probably appear in *The Medical Journal of Australia*.

Stimulated by the success of these two endeavors I then undertook a very long series of experiments on the cadaver in order to study possibilities to discover defects or improvements and to elaborate a technique which might provide the easiest safest and most promising mode of arriving at a good result. The study has not only been extremely interesting but it has ended in the development of two further operations which seem to promise exceedingly well in suitable cases. I propose to present at once a fully detailed description of the operative technique and then to a discussion of the points that seem to recommend the operation or rather the three several operations which I have distinguished for convenience as No. 1 No. 2 and No. 3.

But before beginning I want to say that I think I have good reason for strongly advising prospective operators to follow so closely as possible the detailed technique that will be described. No doubt the actual necessities of an individual case may compel some modifications adapted to the situation but the

rule should be to practice all variations first on the cadaver. I may say that I have tried a very large number of imaginable variations in the endeavor to find improvements or to eliminate difficulties. In my own work each specimen of every series has been radiographed in two positions and the specimen has afterward been boiled down for examination as a dry bone preparation. My experience has several times proved that a modification seemingly attractive at its first conception may show up unexpected defects when tested in practice and such experiments should not be made arbitrarily at the possible cost of the living. At all events if the technique that I have gradually developed be followed carefully and with all its steps strictly according to the sequence laid down a satisfactory result may be confidently expected and it will be attained with comparative ease.

#### INSTRUMENTS

The special instruments that will be required in addition to the stock instruments needed at every operation are as follows: A sharp osteotome, mallet, gouge, forceps, bone shears, sequestrum forceps, lion forceps, rugine, a simple drill ofawl type, wire guides, silver or bronze wire of thick gauge so as to have some stiffness. For work on the cadaver I used copper wire of a minimum diameter of 1 millimeter and a maximum of 2 millimeters.

#### STEPS OF OPERATION NO. 1

1. *Flaps.* I reserve all viable material or at least an ample surplus and trim down later. In a formal operation on the cadaver one may cut flaps like those for a Chopart. The upper flap is cut by an incision starting at a point midway between the tip of the lateral malleolus and the tuberosity of the fifth metatarsal bone and coming across the dorsum of the foot to a point a little behind the prominence of the navicular bone on the medial side of the foot. As the cut crosses the dorsum of the foot it curves forward somewhat crossing the bases of the metatarsal bones. The plantar flap extends a little farther forward on the sole than the upper flap does on the dorsum. But it is better to

have some surplus to cut down than too little to work with.

Disarticulate at the mediotalar joint as in Chopart's operation. The head of the talus and the greater process of the calcaneus are now exposed to view. The talus projects about 5 millimeters further forward than the calcaneus. Clear them somewhat so as to get a better exposure of the head of the talus.

3. With the osteotome cut a horizontal sulcus round the head of the talus at a level about the junction of the upper two thirds with the lower third of the present convex articular surface. The sulcus is deep enough to penetrate the hard crust of the bone as far round as possible. Then deepen the sulcus until the lower third of the head of the talus has been removed. Shave the plane surface underneath the remainder so as to give the plane a certain amount of slant upward as the cut runs backward. The interosseous ligament is now exposed to view.

4. With the osteotome cut through the base of the sustentaculum tali fully with the side of the calcaneus sever its ligamentous attachments and remove it.

5. The next step makes for ease in subsequent work. With the osteotome cut a horizontal sulcus across the facet on the front of the greater process of the calcaneus which formerly articulated with the cuboid. The sulcus is placed at about a level which marks off the upper third of this surface from the lower two thirds. Having made the sulcus cut backward and upward from the mark with the osteotome toward the groove just in front of the convex articular facet on the upper aspect of the calcaneus. This is the groove which contains the calcaneal attachment of the interosseous ligament. The cut removes the sharp upward curving projection at the anterior extremity of the calcaneus. If left alone it would be found to hamper freedom of access to deeper portions of the field of operation (Fig. 1).

6. Cut away the interosseous ligament cleanly from its proximal and distal attachments. Let the assistant grasp the prominent part of the calcaneus with lion forceps and draw it down away from the talus. Cut the lateral, medial and posterior talocalcaneal

ligaments and separate the soft tissues from the upper surface of the calcaneus with a rugine. Then separate the soft parts from the sides of the calcaneus with a rugine aided when required by the knife and take care also to sever the attachment of the calcaneofibular band of the lateral ligament of the ankle to the tubercle on the lateral side of the calcaneus. Never forget to keep all cutting edges directed toward the bone and away from the surrounding soft tissues. Cut short the long flexor tendons of the toes, and that of the hallux as far back as convenient.

7 Now turn to the talus again. The plane of section already begun through the head and interrupted by the attachment of the interosseous ligament is now carried backward and a little upward until the whole under aspect of the bone presents a flat cut surface with a slant upward so as to shave off the whole of the articular surface. In beginning the cut make a sulcus as far as possible right round the downward projecting process that is immediately encountered and then gradually deepen the cut until the process is severed. This is done to avoid fracture and to ensure cutting in the right plane. A plane sloping too much upward will remove too much of the posterior part of the talus. A careless or clumsy operator might cut up into and injure the posterior tibiotarsal ligament or he might even enter the ankle joint. Yet if there is not enough slant the articular surface will not be completely shaved off posteriorly. It is quite easy to shave off thin parings of bone to produce any slope required so there is no need to run any risk whatever by massive cuts. Indeed experience teaches that throughout the whole operation progress attained by small cuts and thin shavings is always the best.

8 We are now ready to return once more to the calcaneus. The removal of the promontory of bone from the greater process has so beveled it down that with the removal of the interosseous ligament it has become possible to apply the osteotome at a slant so as to shave off successive layers of the convex articular prominence of the calcaneus. Shave away this and the bone immediately beyond

until a large plane surface has been produced with a moderate slant up from before backward. It is here very important to shave and not to make any attempt to cut massively a point I have had repeatedly brought home to me in experimental work. If any rash person neglects this advice he will find that ease of fitting will be replaced by difficulty. The plane of section cuts the bone so that the posterior margin of the section reaches a point on the saddle shaped superior surface behind the posterior limit on the convex articular facet (Fig 7). If the plane of section is too horizontal and the cut surface passes right back on to the smooth area on the posterior surface facing the Achilles tendon then close approximation of the bones at this situation is less easy to obtain and there is moreover a greater tendency for the soft tissues to crowd in between the opposing cut surfaces. There is also a much greater tendency to splintering of the bone further back and the increased hardness of the cortical layer tempts to too great violence with the osteotome. But on the other hand if the slope of the section is too steep and if it does not extend far enough back it offers an impediment to the intended advancement of the calcaneus and to the fitting of it in the new position. However it is not a serious matter and if these two extremes be avoided quite good results are obtainable over a considerable range between them (Fig 5 and Fig 6).

I should say here that it is immaterial whether Step 7 precedes or follows Step 8.

9 The following ligamentous attachments of the calcaneus have now been cut: (a) the tibio calcaneal fasciculus of the ankle on the medial side (this attachment disappeared with the removal of the sustentaculum tali); (b) the calcaneofibular band of the lateral ligament of the ankle; (c) the posterior talo calcaneal; (d) the lateral talocalcaneal and (e) the medial talocalcaneal ligaments. The rest of the soft tissues at the sides and over the upper surface of the calcaneus have also been loosened from it. As a result we have now succeeded in mobilizing the bone and are prepared for the next step which consists in pushing the calcaneus well forward.

ward so that the cut surfaces of the two bones can be fitted in close apposition. The anterior part of the calcaneus now protrudes from 1.5 to 2 centimeters in front of the head of the talus instead of being as at the beginning about 0.5 centimeter behind it. In fitting shave down with the osteotome wherever necessary so that a perfectly adjusted close contact is everywhere obtained with an ample advancement of the calcaneus. Also now note carefully whether there is likely to be enough flap material to cover easily when the time comes for removal of excessive projection of the forward part of the calcaneus. If the flap material seems too scanty then the operation will have to be modified by a more radical removal of bone from the calcaneus making the section more horizontal and more ample in its scope. If there is still any doubt proceed at once to trim down the anterior projection of the calcaneus and test the covering power of the flaps. Otherwise it is usually more convenient not to trim down the projection until after the wiring has been accomplished.

10. Now take up the drill and bore a hole horizontally from side to side through the neck of the talus. The bore across the neck should be just behind the head and fairly high up beneath the attachment of the anterior ligament of the ankle joint not low down near the surface of the cut. Leave a guide such as a cannula or a nail in the bore hole and make a similar transverse bore in the calcaneus. To find the right place to make the bore hold the calcaneus forward in the new position it is intended to retain and bore across in a position below and a little behind the hole through the talus the presence of the guide shows the location of this. The bore in the calcaneus must not be anterior. Put a temporary guide through the calcaneal perforation also.

11. Cut and trim the flaps to the exact shape and size desired. But in doing this leave the anterior tendons long so that they can be sutured to the base of the lower flap.

12. Remove the tourniquet and attend to hæmostasis using plenty of hot water.

13. Thread a length of stout silver wire thick enough to have some stiffness (1 to

millimeters) through the bore holes make a final accurate adjustment of the two bones and while holding them in position draw the wire ligature tight and twist up until the fragments are held quite firmly and immovably in the required position. The twisted ends are of course afterward carefully turned in toward the bone.

14. The anterior portion (greater process) of the calcaneus projects very prominently when the bone is held forward in its new and advanced position. If this projection be not trimmed down a much longer plantar flap will be required than would otherwise be sufficient and after healing the comparatively sharp and narrow hard projection in front of the rest of the stump may perhaps invite trouble and discomfort. The projection part should therefore be trimmed down to an appropriate extent and bevelled off to a rounded contour. Be particularly careful to bevel away any sharp edge at the anterior inferior angle. The gouge forceps form a convenient trimming instrument.

15. Suture the anterior tendons to the lower flap in front of the calcaneus as low down as possible.

16. Close the wound putting a short and sufficiently wide tube at each side to provide for oozing. These tubes should be removed within 36 hours. It would be well to elevate the limb by a swing or on a cushion for about the same period or longer. (Figs 1 3 4 5 6 7 8 9 and 10).

#### MODIFICATIONS IN TECHNIQUE

In describing the steps of the operation I have already mentioned some possible modifications of the technique. For instance I have mentioned the effect of altering the plane of section of the calcaneus. Perhaps I should add to the list of warning notices. I have tried to do without wiring. But it was found that when the wire ligature was omitted the calcaneus sagged and fell away from close contact with the talus. I tried to see if bandaging would control this, but repeated X-ray examinations of such cases showed that bandaging was useless and in any case tight bandaging would not be permissible on such a stump. I tried thin wire

and I tried a strip of the patient's own tendon instead of thick wire but I found it was a decided advantage to have some stiffness in the ligature and only thick wire provided this. I also tried wiring from the front in an anteroposterior or sagittal plane instead of transversely but it was not very satisfactory. In my earlier work I cut the tendo achillis but I now think it is far better to leave it intact because it helps to keep the posterior part of the calcaneus well up in apposition with the talus supplementing the action of the ligature. It seems to me after some practical experience a harder problem to ensure close apposition of the cut surfaces of bone posteriorly than it is to maintain the calcaneus in a fully advanced position. Another modification of technique that I have tried and condemned was to make an incision behind adjacent to the tendo achillis and after using the rugine to introduce the osteotome and cut the top of the calcaneus horizontally from behind forward instead of from before backward. I tried this several times both with and without section of the tendon but I cannot recommend it any way. I thought the posterior incision might come in usefully for drainage but it does not seem to be required and incisions in that situation have some special disadvantages.

I have already mentioned two operations carried out on the living patient before I had begun experimental work on the cadaver and worked out the best technique. But since this has been done I have had an opportunity of testing on a living patient the fully developed operative scheme that I have described in such detail as the method to be advised and followed.

The patient a young man W. A. K. age 27 was operated upon July 10 1916. He had been employed on railway construction work and his foot had been crushed by a falling rail some time before. He had a healed cicatrized deformity of the front of the foot and being quite unable to walk he was sent into hospital for amputation. Instead of performing a Syme or a subastragloid which would otherwise have been the only practical alternatives I did the operation described above. The result has been everything that the most sanguine expectation could have wished for. The stump of course looks very like that of a successful Chopart. Roentgenograms show that the rem-



Fig. 1. Side view of bone of tarsus in a normal foot. Note the extent of backward projection of the calcaneus (posterior arm of lever) as compared with that remaining after operations No. 1, No. 2 or No. 3. Note also how in the normal foot the forward set of the talus in relation to the calcaneus is such that the head of the talus projects beyond the greater process of the calcaneus. The distance is approximately 0.5 centimeters in the male foot. In operation No. 1 the calcaneus is slid forward beneath the talus until the extremity of the greater process projects some 2 centimeters in front of the head of the talus. In No. 2 and No. 3 it is slid forward beneath the talus. The figure shows also the normal slope of the long axis of the calcaneus from behind upward. The roentgenogram was taken with the patient lying down and the foot in a position of extension as is shown by the angle shown with the tibia.

nants of the talus and calcaneus have preserved their new relationship and are united to form one bone. The backward projection of the calcaneus existing in the normal foot which is the weak spot of a Chopart has been reduced until it is now quite small and the heel pad is brought forward so that the weight is transmitted more directly through it. While the mechanical advantage of leverage possessed by the tendo achillis has been practically abolished by the shortening of the arm of the lever yet the knee flexing function of the gastrocnemius is unimpaired since the tendon is intact. Ankle action is free the calcaneal pad is horizontal and ample in amount and walking is easy and comfortable (Figs 11, 13 and 14).

We may now consider what seem to be the good points of the operation which has been described. The result obtained in the case of W. A. K. sufficiently demonstrates that it is an operation well worth doing if the condition of the foot permits especially as it leaves the way open for other less conservative operations without prejudice to their success. It could be turned into a sub-





Fig. 3 and 4. Operation No. 1. Two roentgenograms from experimental resection. It is seen that the plane cut surface on the calcaneus and talus respectively are brought into apposition and held in place by a wire ligature which is drawn through horizontal drill holes above and below parallel to the plane of the cut surface. The denser shadow looking like a core in the central part of the talus produced by the shadow of the head and neck of the bone. It will be seen that the wire passes through the shaded part and not through the lighter peripheral part which belongs to the body of the bone.

weight evenly along the whole anteroposterior length of the part intended to serve as the tread. The mechanism is exactly the same as that provided for the feet of a tractor wheel built on the pedrail principle and the function is also exactly similar.

The malleoli remain also. Their retention leaves a natural prominence on either side which gives opportunity for utilization both as vertical and horizontal bearing points. The presence of vertical bearing points is useful to the maker and wearer of artificial limbs because they make it impossible for the stump to work up and down inside the appliance after it had been laced on. This tends to add security to the limb and strength and ease to the walking power. As horizontal bearing points they provide a comfortable and efficient means of taking twisting strains in an artificial limb. But as to this there will be different attitudes among makers according to the particular style of prosthetic appliance they sell. The makers

of one very good type of these limbs say that it is a great advantage to have the malleoli to take up twisting strains. Another maker claims that the limbs he supplies never show any tendency to twist the struts being sufficiently taken up by the grip of the apparatus when firmly laced on the leg or leg and thigh.

However apart from artificial limbs there is yet another useful function that can be provided by the existence of a large sized extremity to the stump and the prominence of the malleoli. It makes the stump very much more convenient for a man of the poorer class who cannot afford an artificial limb and who wishes to get about with the much less expensive substitute a short boot. The boot is laced up above the ankle and it can thus be firmly held to the stump without any slipping up and down and without any twisting. The wearer of such a boot is given an additional advantage in the circumstance that the limb he possesses is of the most convenient length for the purpose. Of course





I k H I c O l I N T I t t l k k a m f m I r m t l  
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 I t l t h r t u l a t t h l I k t t n g f l k t h p t r n d  
 f t h p e u f B l t t l m g l a t t t h m l l k t

a boot is likely to be but a poor substitute for a good artificial limb but the certainty.

But there can be no doubt that one of the most important advantages which the new operation provides is the surprisingly good result. In all low amputation the tread is a matter of extreme importance. In this operation and also in the No. 1 and No. 3 operations the natural calcaneal pad is preserved on the weight bearing area and in its natural condition. After Hargraves's or Hunkeler's operation the patient tread on what was formerly the back of the heel a part not naturally adapted for the purpose. In Ingersoll's and the subtrochanteric amputation a well is in a Syme's the calcaneal pad is dissected off its natural seat and replaced by a flap on another seat. The treatment of the calcaneal pad is a specially constructed arrangement of the tissue adapted to serve the function of a sort of weight bearing and shock receiving organ for the tread of the foot. It must therefore be a great advantage other things being equal to be able to preserve this pad intact for its original purpose. My operation not only preserves this but the area of the bearing

surface much larger both transversely and in an anteroposterior direction than it is in any of the other Le Fort and Chopart's excepted. The two latter provide about the same surface (Fig. 14).

Chopart's amputation has fallen into disrepute because it was so often followed by a non-weight bearing stump. In the classical Chopart operation all that is done is to disarticulate through the mid tarsal joint and cover the front with an upper and lower flap. Later on the Achilles tendon very frequently succeeded in pulling up the back of the heel thus tilting it into a nearly perpendicular position with the hip lowered end of the greater process projecting downward like a knife edge and causing tenderness on the spot where the weight was borne. At the same time the transverse ligament was pulled the head of the talus into a rotation of downward flexion carrying the claw with it. In its new position the claw had to transmit weight and carry thrusts and cicatricial tissue is not adapted for that purpose. The tilting appears to have occurred even when the Achilles tendon had been cut. In other cases the calcaneus gradually rotated on an anteroposterior horizontal axis and



Fig 7

Fig 8

Fig 9

Fig 10

Fig 7 Operation No 1 bone preparation seen from the medial aspect. This should be carefully compared with the roentgenogram of a normal foot shown in Figure 1. The comparison shows clearly the radical alteration in the leverage power of the Achilles tendon which must be produced by the new and very greatly advanced relative position of the calcaneus. In this specimen the cut made on the calcaneus has reached as far back as the top of the smooth area on the posterior surface. The calcaneus has been held for a short time there is hardly any back and projection. A smaller degree of advancement (see roentgenogram Figures 5 and 6) seems to give quite a satisfactory result. Note the position and the slope of the planes cut on the talus and calcaneus. The relative direction of the slope can be seen by comparison with the roentgenogram of the normal foot. Note that the up and back and slope of the talus should not be carried up into the ankle joint but should be approximately shown. Note the position of the wire ligature and of the bone holes. Note that there is still some projection of the anterior part of the calcaneus although it is seen that the greater process has been trimmed away.

Figs 8 and 9 Operation No 1 bone preparations. Front view of a right foot specimen (fibula removed) and of a left foot specimen with fibula in place. Note that the lower part of the head of the talus has been sliced off by a side

table cut and that the corresponding plane surfaces on the calcaneus and the talus are accurately adjusted and firmly held together by a stout wire ligature. The wire is seen to pass transversely through the neck of the talus behind the head but in front of the body of the bone the ankle joint being undisturbed. The vertical distance of the bone holes from the cut surfaces of the bone can be seen. The rough area on the front of the calcaneus is produced by the surface of cancellous tissue left after trimming away most of the greater process to reduce the anterior projection of the bone. Note that in this and in all the operations the sustentaculum tali has been removed flush with the side of the calcaneus.

Fig 10 Operation No 1 bone preparation posterior view. At the bottom note profile of tubercles marking site of the natural calcaneal tread. The rough part above this corresponds with the insertion of the Achilles tendon and above this is the smooth area on the posterior surface corresponding with the bursa which lies here between tendon and bone. Then above this transversely can be traced the line of apposition between the cut surface of the calcaneus and that of the talus. It will be seen that the ankle joint is unaffected and a portion of the trochlear articular surface of the talus can be seen just beneath the table. A portion of the wire ligature can be seen though rather dimly in the left of the calcaneus.

assumed a varus position causing the patient to walk on the outer side of the stump extremity.

#### A NEW PRINCIPLE

Now I have in this operation introduced an entirely new principle. My idea is to push forward the calcaneus so as to shorten the posterior arm of the lever and thus to lessen the mechanical advantage conferred on the Achilles tendon and thereby prevent the tilting up of the calcaneus which occurs after Chopart's amputation. The anterior arm of the lever gets a little extra assistance

from new attachments of the anterior tendons. Even if bony union of the talus and calcaneus did not occur the area of fibrous union would be broad enough to give considerable strength. The lessening of the mechanical advantage of the Achilles tendon would be secured permanently.

As regards any propensity to horizontal rotation of the calcaneus on an anteroposterior axis producing varus deformity I think we can look forward with confidence to the elimination of any such tendency. In the first place the lessening of the vertical diam-





Fig 16



Fig 17



Fig 18

Fig 16 and 17. Operation No 3. Figure 16 is a roentgenogram and Figure 17 is a photograph of the same cadaver experiment after making it into a bone preparation. Side view fibular aspect shows plane of section of tibia and fibula and of calcaneus. In the dry bone preparation it is very clearly seen that the plane of section of the calcaneus in front takes off at the lower and anterior part of the rim of the con ex articular facet just behind the depression which receives the attachment of the interosseous ligament. The site of the depression is clearly shown. Note that the plane of section of the calcaneus does not correspond with the long axis of the bone but has a slope relatively upward so as to be level (i.e. parallel with the horizontal) when set in position. This ensures that the natural tread of the heel shall remain the point of contact with the ground. Note that the advancement of the calcaneus brings the line of pressure within the perpendicular of the tibia. Note the position of the transverse boreholes through the tibia and the calcaneus. It

will be seen that the tibia is perforated comparatively high above the section so as to obtain firmer bone. The anterior portion of the calcaneus has been very freely trimmed away.

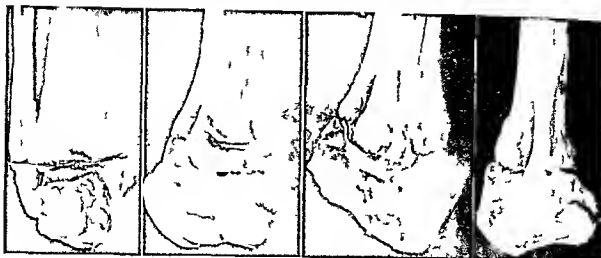
Fig 18. Operation No 2. Roentgenogram given in an anteroposterior view. Note the plane of section of the tibia between the malleoli. Note the method of ligaturing the calcaneus in position by a wire traversing the calcaneus from side to side and then passing out horizontally in the same direction through the bases of the malleoli. By pulling up the wire taut the calcaneus is brought up and secured in apposition plane surface to plane surface with the tibia. In this case the wire had not been pulled up quite tight enough to procure absolutely perfect apposition and it illustrates the desirability of attending to this point carefully. A wire that is too thin breaks if the tension exerted is very great, while one that is too thick is not pliable enough and when pulled on may tear the bony tissue of the malleolus.

As further advantage over Chopart's operation it may be mentioned that the sharp border of the calcaneus at the lower margin of the calcaneocuboid facet on the greater process has been taken away. And finally there is no projecting talus to be thrust against an overlying cicatrix.

In connection with the new operation it must be remembered that never again will the patient have to use his tendo achillis to rise on the toe pad in walking, running or jumping. Therefore the weakening of the muscular power of the back of the leg produced by shortening the backward projection of the calcaneus is no real loss for the muscles of the calf will never again be called upon to do anything nearly equal to the work that was formerly required of them.

#### FURTHER EXPERIMENTAL STUDIES

In addition to developing the technique of the operation described in the foregoing pages I have since becoming interested in the subject done a good deal of experimental work in connection with the type of osteoplastic amputation through the tarsus in which the talus has been eliminated altogether. The work has been quite worth the trouble for two practical operations founded on the type have developed from the series. I shall refer to these as No 1 and No 3. Really No 3 was the earlier one to evolve itself and No 2 was an attempt to improve upon it where the other seemed to show weak points. I have not adopted a nomenclature based on seniority but it is based on the order of conservation of bony structure. It is probable that in No 1 a better operation than



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f t t u l t h th b o b h t r n d d

l th l l t e d t s t l p o t

th l f th t b l F g d t h r n u

d t m m g f a b l m l l d p l y d r y l l y

No 3 has been found still both have points of interest and both are certainly operations for practical consideration. I shall therefore describe both but I shall discuss the theoretical basis of technique chiefly in connection with No 2 as I regard this one as the operation of choice. I shall moreover describe No 1 after No 3 but in spite of the seeming inversion of sequence it will be really more logical and convenient to adopt this order. The full discussion of the meaning of certain detail common to both operations will not be found until they are met with later on under No 3.

#### OPERATION NO 3

The operation No 3 proceeds as follows

1 An upper and a lower flap are made but shorter than in No 1. It is difficult to give an arbitrary line but one encircling the foot at the lateral plane corresponding to the

prominence of the navicular bone is ample to mark the extreme anterior limit for the length of the plantar flap and more than enough for the anterior flap. The distal part of the foot is removed by disarticulation at the metatarsal joint.

2 Then cut off the sustentaculum with an osteotome as in operation No 1.

3 Next seize the head of the talus with bone forceps and carefully disarticulate it cutting close to the bone to avoid injury to blood vessels.

4 The next step is to remove a slice of the distal extremity of the tibia and the lateral malleolus at the same level as that prescribed for Syme's operation. But the osteotome is substituted for the saw in carrying this out. If a preliminary sulcus be cut round the bone as far as possible by gradually deepening this the bone can easily be cut as cleanly

and even as by a saw and just as safely or more so. The osteotome is indeed the key which unlocks the problems of tarsal osteoplastic amputations and I have found it not less suitable for knee joint excisions. When one finds what can be done with its aid it makes one marvel that its value for such purposes should not be better appreciated.

5 If an osteotome be employed an operation preserving a segment of the calcaneus more or less like that of Le Fort's is easier to carry out than one such as a Syme which requires resection of the whole bone. This discovery will be made at once by any experimenter. In Le Fort's operation the horizontal section of the calcaneus is made just below the level of the sustentaculum. It is far better to adopt a higher level. That of operation No. 1 will give a good workable result but I recommend a section just a little different taking off at the base of the convex articular facet about the bottom of the rise of the smooth articular surface. The calcaneus is broader here than it is at a lower level. The plane should not be parallel with the long axis of the calcaneus but should have a moderate slope upward and backward taking it up to the apex of the smooth surface above the insertion of the tendo achillis and then shaving it down until we procure a sufficiently broad cut surface to place beneath the cut on the distal extremity of the tibia (Fig. 2). The reason for the inclined plane will be discussed later. It is convenient as a preliminary to shaving down the calcaneus to remove first the projection of the upper and anterior portion of the greater process. Though massive cutting is satisfactory for the tibial extremity as in Step 4 it is not to be recommended for the calcaneus being less safe and under control than shaving. The surplus lengths of all cut tendons should be removed well back.

The reader will now be able to notice that we have contrived a bone section of the tibia and fibula on the one hand and of the calcaneus on the other hand which is approximately the same as that adopted in Le Fort's operation but it is brought about by an entirely different method. It is done more easily and simply with very much less crude

violence with a much smaller skin incision and with much less interference with the blood supply of the calcaneal fragment.

The next two steps are not paralleled in Le Fort's operation.

6 The calcaneal remnant is pushed well forward and the surgeon decides how far the bone should be set in this position of advancement. It will probably be seen that the best position is one that leaves (in a male foot) from 2.5 to 3 centimeters projecting forward from the front of the tibia the more the better as this brings the deepest part of the bone the natural tread more directly in the line of pressure. Most of the projecting mass of bone will have to be cut back.

7 The greatest difficulty of the operation arises at the next step when some method of keeping the calcaneus in close and fixed apposition with the tibia has to be contrived. It will be found that not only does the calcaneal fragment tend to fall away from the tibia but the soft tissues tend to crowd in at the side and posteriorly. There is also some tendency for the fragment to rotate horizontally on an anteroposterior axis so that it lies more or less on its side. These tendencies are more pronounced if the section of the bone has been parallel to its own long axis instead of sloped upward and backward to make it approximately parallel to the horizon. They are also more pronounced in a low cut section. There is another tendency to the assumption of a skewed position of the calcaneus a rotation around a vertical axis.

The cancellous bone tissue with which we are dealing is soft and particularly so in patients who have been confined to bed and unable to use the foot for a considerable time when one finds that it cuts like cheese. The surface over the cancellous portion of the tibia is almost without any compact crust and what there is is very thin and unresisting.

Nailing the bones together is quite useless. I have tried it. I have also tried autogenous dowels cut from the individual's own fifth metatarsal bone with equal want of success. I found the best thing to do was to get a very thick wire ligature so thick that it would not readily cut the soft bone and to hold up the calcaneus with it. It transfixes the anterior

portion of the tibia from side to side well up and loops through a transverse borehole in the calcaneus. This borehole through the calcaneus must not be too far forward. It is not always easy to draw the posterior part of the calcaneus up to the corresponding part of the tibia with the wire ligature and prevent the crowding in of the soft tissues. This difficulty when it occurs is probably not so great in the living patient as it seems in the cadaver for if the Achilles tendon is uncut it will assist in holding up this end of the calcaneus. Hemostasis is attended to before wiring is completed.

In connection with the difficulties of securing good and enduring apposition in tarsal osteoplastic amputations I am not now surprised to note the statement made in the textbooks that after Pirogoff's operation bony union of the calcaneal fragment often fails to occur. If perfect apposition is difficult to get in the operation I have just been describing it must be still more so in a Pirogoff where no special means are employed for the purpose.

When flap material is scanty the calcaneus can be pared down more and cut back further until it becomes possible to complete an operation with an amount of flap not very greatly larger than that demanded by a Pirogoff (Figs 15, 16 and 17).

#### OPERATION NO

We come now to consideration of the operation which I have labeled as No. 4 of the series though it is the last to be described. It was evolved as an attempt to improve on No. 3 by overcoming what seemed to me to be defects and it expresses the result of quite a large amount of experimental work. After spending much time and much thought on the technique I now feel able to recommend it very confidently.

It will I hope be sufficiently understood by the following description.

1. The remarks on incisions and flap material in connection with operation No. 3 apply also to No. 4.

The sustentaculum tali is removed just as in the other two operations.

3. The talus is removed as in No. 3.

4. The soft tissues are separated from either side of the calcaneus. The most important part to clear is that immediately behind the site of the sustentaculum on the medial side and the corresponding area on the lateral aspect. Further back the separation need not extend far down the sides of the bone. The rugine is also used to separate the soft tissues from the saddle shaped superior surface of the calcaneus behind the convex articular facet. The tendons severed in removal of the anterior part of the foot and lying close adjacent to the side of the calcaneus should be cut back also as far as conveniently possible. Then the remnant of the anterior ligament is cut away from the tip of the lower extremity of the tibia. Finally the soft tissues are separated from the surface and borders of each malleolus great care being exercised to avoid injury to vessels nerves or skin the cutting edge of knife rugine or osteotome being kept steadily close to and toward the bone.

5. It will be well now to remove the prominent upper and anterior part of the greater process of the calcaneus so as to prepare for the easy performance of the next step which is an important one.

6. We now have to make a plane surface on the upper aspect of the body of the calcaneus. This is destined to fit beneath a plane surface to be made on the distal extremity of the tibia between the malleoli. We desire so to carry out the operation that when it is finished the natural heel pad shall be preserved to constitute the tread of the stump. If the reader will recall to mind the anatomy of the undisturbed foot he will recollect that in the normal state the long axis of the calcaneus does not lie horizontally but forms the posterior limb of an arch and its general direction is one rising from behind forward. He will also recollect that the tread of the heel is at the base of this arch and behind the plumb line of the tibia. There will be no ankle joint to pivot on and distribute stresses and we must make an effort to get the tread as nearly as possible in the line of the tibia. This means advancing the tread and we must at the same time keep the inclination of the calcaneus unaltered so as to retain the same

heel pad To keep the calcaneus at its natural tilt it is manifest that if our plane surface is to be really level in relation to the horizon it must be sloping to a moderate degree upward and backward in relation to the long axis of the bone We can then slide the bone forward at its old inclination and so retain the original point of pressure But to get this point approximately in line with the tibia it will have to be pushed forward very considerably so our section must extend as far back as is conveniently possible that is as far back as the posterior surface And in order to get a broad enough section to give a good area for apposition with the tibia it will be found necessary to take off rather more than just a superficial slice of the upper aspect of the calcaneus behind the convex facet since the saddle shaped portion behind the facet is so narrow at the top Different specimens of the os calcis vary so much that one cannot give precise instructions as to the amount of bone required to be removed (Fig 2)

I recommend that no attempt should be made to remove the upper segment of the calcaneus in one piece by massive cutting The method looks attractive but gives uncertain results On the other hand the shaving down method gives complete command of results and is easy In this way we cut down first the prominence which marks the upper part of the convex articular facet The osteotome then shaves back along the saddle behind the prominence until it reaches as far as the upper part of the smooth hursal area of posterior surface above the attachment of the Achilles tendon At first the plane surface is broad anteriorly but very narrow behind We go on shaving down the bone until a fairly broad surface exists along the whole area The anterior margin of the plane of section has now reached a level corresponding roughly with the beginning of the rise of the convex articular facet just beyond and above the sulcus accommodating the interosseous ligament (see the line of section shown in drawing Figure 2) The line of section recommended for operation No 1 will do but the one here described is preferable But the section should not be carried so low and so far back at its posterior end as

the insertion of the Achilles tendon If it were done the surface of the bone corresponding to the insertion of the tendon would adhere to the tendon fibers and it would probably also be comminuted The surface layer should be allowed to remain and the broken bits if there are any should not be forcibly dragged away as they will continue to live and may be useful sources of new bone In an ordinary case there is really no need to manufacture technical difficulties by going thus low down with the back of the cut We have to produce an upward and backward slope on the surface and this slope besides being correct theory is much easier in technique than a cut made parallel to the long axis of the calcaneus a fact anyone can prove for himself on the cadaver The upward slope clears us from complications with the tendon and it is also afterward more easily adjusted to the tibia Indeed some of my specimens show that really excellent results can be got even without reaching as far back as the posterior surface (Fig 3) Such a simple operation is quite easy

A plane horizontal surface has now to be formed on the distal extremity of the tibia between the two malleoli Cut away with the osteotome the anterior lip of the extremity It is not necessary to avoid massive cuts on the tibial extremity as it is on the calcaneus A vertical cut through the lip may be made on either side and then a horizontal sulcus across joins them this is gradually deepened cutting the plane from before backward The plane of the cut must be high enough to shave cleanly away the articular surface of the top of the concavity of the arch or dome and it should then be extended back until the posterior lip is also removed extreme care being taken not to drive the osteotome into the soft tissues on the posterior aspect The whole surface can then be dressed even by shaving Care must be taken to preserve uninjured the compact articular surface layer of bone on the deep aspect of both malleoli If this layer of hard bone be missing the wire to be employed afterward will cut through the soft cancellous tissue which remains just as if it were cheese The main purpose of the existence of the malleoli



so far as this operation is concerned is for the use that may be made of this hard and resistant layer of bone on either side.

8 If an attempt is now made to fit the cut surface on the calcaneus beneath that on the tibia it will be found that the lateral malleolus is too thick and too long. The next step therefore consists in hearing off half or more of the downward projecting length of the tibular malleolus so that it will not project any more than the medial malleolus. It is then carefully thinned and bevelled to reduce its lateral thickness, particular attention being directed to the posterior portion where it is thickest. Treat the soft parts always with respect. The covering is very thin over the prominent posterior border where the bone is subcutaneous.

9 Now take the drill and make a horizontal drill hole through each malleolus in a transverse direction. The drill hole will not really be quite horizontal and it is decidedly an advantage for it to slant a little upward because the upward inclination makes an angle around which the wire ligature is to be drawn less acute and therefore makes it easier to pull up and less apt to break. Begin each hole on the deep aspect of the malleolus and make it pass through the hard articular lining as near the base of the malleolus as may be and about midway between the anterior and posterior limits of the malleolus. Place a spatula or similar flat instrument between the superficial aspect of the malleolus and the soft tissues so that the point of the drill when it emerges will not penetrate anything except the bone.

10 Next make a trial fitting of the calcaneus to the tibia plane surface to plane surface. Remember that we wish to bring the point of contact with the ground forward as near as may be to the line of the tibia and that the tilt of the calcaneus is intended to be so adjusted that the natural pad of the heel is to occupy the pressure point as before. We shall therefore have to slide the calcaneal fragment forward to an approved situation which must be marked and if the slope of the cut is not correct enough it can be altered by shaving off bone either from the tibial surface or from the calcaneal. By measurement and

by marks we also note where a straight line joining the drill holes in the malleoli would cross the calcaneus when fitted in the desired position. It is important to get this line correct for on its correctness depends the registration or alignment of the calcaneus in the exact position intended by the surgeon as shown at the trial adjustment. Having secured all the required information we then make a side to side horizontal drill hole through the calcaneus in the line that is to correspond with that between the two malleoli and at a depth of about 6 or 7 millimeters ( $\frac{1}{4}$  inch) beneath the cut surface. The soft tissues are again protected with a spatula in the way already described.

11 It will be convenient to remove the tourniquet and attend to haemostasis in the deeper parts of the operation area at this stage before proceeding to wire the bones. In the meantime a guide may be left in the calcaneal bore hole.

The wire that is to be used for drawing the bones together and holding them in position must be strong enough to stand a fair amount of tension and must be at the same time pliable. If too thin it is apt to break. In my experiments I chiefly used copper wire of one millimeter diameter. This occasionally broke but anything much thicker was too stiff. I think silver wire not less than 1 millimeter nor more than 1.5 millimeters diameter would be the most suitable for operations on the living. I have never tried soft iron wire highly recommended by Hey Groves for bone work.

Haemostasis having now been attended to a piece of wire some 20 centimeters (8 inches) or so in length is taken and threaded through the transverse borehole in the calcaneus. The free ends of the wire on either side are then passed through their respective malleoli entering the boreholes on their deeper aspect and emerging superficially the soft tissues being protected from injury meanwhile. When the drill was employed the two ends are then drawn quite taut while the calcaneus is carefully pushed into position. At the same time the soft tissues at the back are pushed away by a suitable instrument and prevented from intruding between the cut

surfaces of the calcaneus and tibia while the bones are being approximated. When the maneuvering has been completed and the wire is quite taut the calcaneus is held firmly closely and immovably in accurate position. The wire ends are then brought forward across the front, twisted up securely together and the points tucked in safely.

11. The anterior portion of the calcaneus now projects forward far beyond the lateral plane of the front of the tibia. This projection is now bitten down with gouge forceps or otherwise removed until it is reduced to a prominence of convenient size or if flaps are rather scanty it is made flush with the tibia. No sharp corners are left.

12. The flaps are now finally cut down to convenient size and shape if necessary hemostasis is secured and the wound is closed. A wide drain should be left in for 36 hours.

As an appendix to step 11 I might say that in two earlier operations I used slices of the individual's own flexor longus hallucis tendon as a ligature instead of wire. I did it in the following way. Before proceeding to amputate the tendon was displayed by incision and dissection its end detached from the toe and it was then held out of harm's way while the amputation was done. Later on when the sustentaculum and the talus had been removed the tendon was cut proximally as far up as possible close to the tibia. It was then carefully split by slicing along its whole length. A single length not being long enough the two sliced ends were joined to make it longer. The tendon was pulled through the drill holes by slipping backward through the

holes a loop made by bending double a length of fine steel wire of the kind used for a nasal polypus snare. The wire was pushed through loop first and when it appeared on the other side the end of the tendon was placed in it and brought through by pulling up the wire. The drill holes need to be large and probably thinner tendon would do. The tendon experiments seemed to be satisfactory. Possibly kangaroo tendon, chromic gut or salmon gut would suffice if great care were taken to keep it taut when making the knot. But wire is an easier material to work with and its stiffness combined with pliability which causes it to stay is put, returning its curves allows it to function additionally as a sort of splint as well as a ligature which is another advantage.

Finally in Operation No. 12 as in the others described if flap tissue is scanty the calcaneus can be still further cut down and cut back and the malleoli can be shortened so as to be just sufficient to give a hold to the ligature by their articular surfaces (Figs 18, 19, 20, 21 and 22).

NOTE.—I may add as a postscript that on March 30, 1910 I had an opportunity of performing operation No. 3 on the living subject. It was not a favorable looking case to begin with as there was so much destruction of skin that no suitable material existed for an upper flap and almost none of the covering of the lateral malleolus had to be cut away before bleeding could be obtained. Nevertheless by using a surplus from the medial side the lower flap was so maneuvered as to provide a sufficient cover which was sutured sparsely and without a drainage tube. The wound healed forthwith without any supuration despite a thin and considerable area of mummification at the edge. The final result promises to be as excellent for this case of operation No. 3 as was obtained with W. A. K. above described when the No. 1 type of operation was employed. However it will be wiser not to describe the case at any greater length here but to wait until it can be reported with later experience.

# DEPARTMENT OF TECHNIQUE

## NEO-INSERTION OF THE ROUND LIGAMENTS

### CABALLERO'S OPERATION

By EDGAR NICHOLSON M.D. BUENOS AIRES ARGENTINE  
Surgeon at Rivadavia Hospital

At the seventh Pan American Congress of Medicine which assembled in San Francisco California in 1915 I presented a short report in which in analyzing the different methods employed to correct retrodisplacement of the uterus I tried to show the advantages which that of Doctor Jose Maria Caballero my esteemed professor at the Rivadavia Hospital offers.

As I have had since that time a considerable number of cases and as the end results with this method have been excellent I wish to call attention to the operation which I valued very highly in our country for I do not doubt that it will be considered favorably by many European and American surgeons. I will not discuss the various methods hitherto employed with which are connected such names as Dolis Spinelli Gilliam Simpson Kelly Arce of Buenos Aires Spruth Wylie Baldi Dartigues Jonnesco etc nor the reasons I have for preferring the technique of Dr Caballero as this point was covered in my former communication to the San Francisco Congress. However I would emphasize that this article is written for no other purpose than to bring this procedure to the attention of foreign surgeons and by reporting the good results obtained in our 1233 operations at the Rivadavia Hospital to overcome any objection which may be made to it.

The procedure has been called by its author neo insertion of the round ligaments. It is employed by us to correct only fixed or irreducible retrodisplacements or in those cases in which some other abdominal condition such as disease of the adnexa appendix etc has made necessary a laparotomy since in the case of easily reduced retroversions or retroflexions in which the adnexa are in a healthy condition we always practice the Alque Alexander Adams operation which without doubt produces the ideal result both from the anatomical and physiological points of view.

For the steps in the technique I quote from the article by Dr Caballero published in 1913<sup>1</sup>

Step 1 Median laparotomy with a small incision

Step 2 Reduction of retroversion. If the retroversion is mobile reduction is easy. If there are adhesions they should be separated with care. In this step lesions of the adnexa must be treated conservatively.

Step 3 Withdrawal of the round ligaments through the incision and the creation of a muscular aponeurotic canal. With a pair of Kocher's forceps the round ligament is seized about 2 inches from its uterine insertion and another pair of Kocher's forceps is introduced into the inferior portion between the rectus muscle and its aponeurosis as far as the outer border of the rectal sheath which is recognized by its resistance. Now raising the hand the forceps are raised until vertical while the other hand exerts pressure on the abdominal wall passes into the abdominal cavity. This perforation occurs very near the internal orifice of the inguinal canal. The forceps that have perforated the wall are now opened the round ligament held by the other forceps is seized and the forceps closed. The ligaments are drawn through the canal already described as far as the abdominal incision. The same technique is followed on the opposite side.

Step 4 Fixation or neo insertion of the ligaments. Using No 3 catgut the ligament loop is fixed to the aponeurosis of the rectus on each side about 5 millimeters from its border. One simple stitch is sufficient to hold firmly.

Step 5 Suture. The abdominal wall is sutured in 3 layers the two deeper layers with catgut and the skin with silk worm gut.

As is evident this method is a modification of the Dolis technique. It is very much like the Gilliam operation. It does not present the

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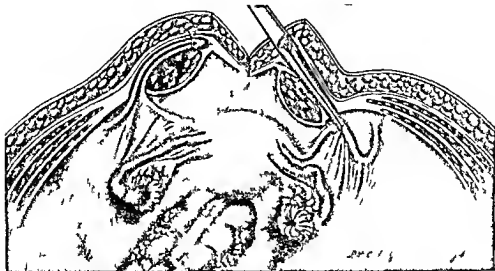


Fig. 1. Drawing showing author's technique.

dangers of the Dolens operation however and is incomparably more simple to do than the Gilliam operation. The real danger in the Dolens method lies in the possibility of the strangulation of an intestinal loop by the ligaments, an accident which cannot occur in the Caballero technique.

However in the August 1917 issue of *SURGICAL GYNECOLOGY AND OBSTETRICS* I find that Thomas J. Watkins of Chicago reports a case of intestinal obstruction following a Gilliam operation, the obstruction having been caused by one of the ligaments. I cannot understand how sufficient space could remain so that an intestinal loop could become obstructed if the operation were carefully done, since the instructions as to technique strongly emphasize the importance of introducing the Kocher forceps so that they will grasp the round ligament as near as possible the internal ring of the inguinal canal and if possible so that they will pass through the ring itself. If this technique is strictly followed it would be practically impossible to leave sufficient space to cause internal trouble. At least we have never had such an accident in the Argentine Republic.

In France they have objected to Dr. Caballero's operation as one done blindly, exposing the operator to the danger of wounding the epigastric artery in passing the Kocher forceps near the internal ring of the inguinal canal. As we know this artery at this level turns around the external edge of the rectus. The argument is not well founded as I cannot imagine how a vessel of the size of the epigastric could be injured with a blunt pointed instrument such as the Kocher

forceps. Besides it is not necessary to use any violence whatsoever to perforate the posterior sheath of the rectus muscle since at the level at which the operation is performed the posterior sheath consists only of a thin layer and the peritoneum.

On the other hand this procedure should be controlled by the hand which has been introduced into the abdominal cavity. In this position the hand serves as a guide in indicating the exact spot at which we should make the perforation in the wall. In thin women it is possible to do this part of the operation under direct vision since by raising the abdominal wall a little the internal ring of the inguinal canal can easily be seen.

Up to the present time I do not know of a case of retrodisplacement which has relapsed after the operation of neo-insertion. I have had the opportunity of observing many patients who have been operated upon and who have become pregnant many times, the pregnancies terminating in normal labors. Among our cases we have observed some in which the neo-insertion operation was done during the first months of pregnancy and with the exception of one or two cases of miscarriage as a consequence of the intervention itself, the pregnancy has gone on to term and labor has been normal.

In some patients it has been necessary to operate after neo-insertion for some other abdominal affection and in such cases we were able to inspect the field of the neo-insertion and we have found that in the area through which the round ligaments run there has been formed a tunnel through which the ligaments slip with ease.



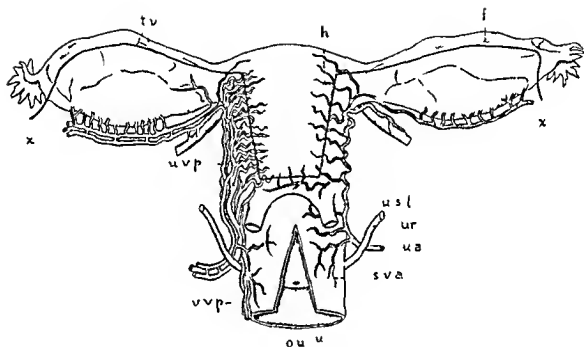


Fig. 2. xx Line of incision tr. tubal vessels f. hel. c. ne branches f. fallopian tube t. p. uterine  
 enous plexus t. p. vaginal enous plexus t. s. l. uteroacalliment tr. ureter u. uterine art. v.  
 t. t. superior vaginal arteries t. vaginal open behind ou. os uteri

(T. d. q. e. for Bl. d. s. Hyster. d. v. — I. d. V. n. H. ser.)



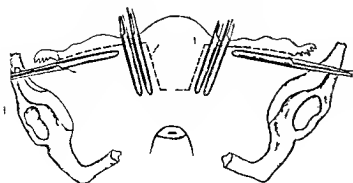


Fig. 3. Method of clamping the parametria.

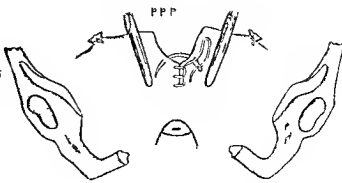


Fig. 4. Method of clamping the parametria.

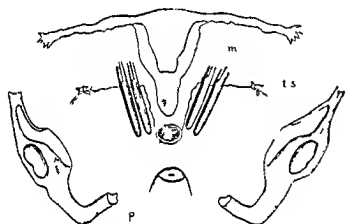


Fig. 5. Method of clamping the parametria.

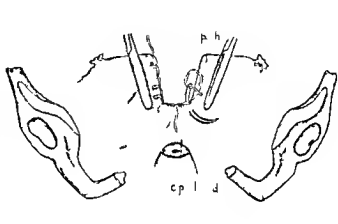


Fig. 6. Method of clamping the parametria.

on both anterior and posterior surface is lifted by undercutting with a sharp knife. Strong traction is now made in turn between the volsellum controlling and holding the body of the uterus and the forceps applied on each side and with a few strokes of the knife the uterine musculature is separated from the parametrium and the uterus is freed down to the internal os.

With dissecting scissors the cervical musculature and mucosa is coned out for any distance, even to the external os if so desired, and lifted out with the attached body of the uterus (Fig. 4). Neither ovarian nor uterine artery having been severed (Fig. 5) the suturing may now be begun. The first suture is placed deeply uniting the anterior and posterior border of the cervical cone. The internal forceps on the edge of the severed broad ligaments are now removed and the remaining forceps are drawn together and held until the cut edges on each side can be united with lock stitch the one to the other (Fig. 5). The lateral edges are united first from the posterior surface

and after removal of the remaining forceps from the anterior surface.

If a generous border of peritoneum has been left there will be no surface uncovered by peritoneum except possibly at the tubal location. This can be better covered and at the same time the stump which represents a skeleton uterus can be elevated by passing a suture through each round ligament about one inch from the uterine attachment and by tying them together over the uterine skeleton (Fig. 7) and fixing them thereto.

Certain conditions may necessitate modifications or additional manipulations. If the fallopian tube arc to be removed an eight inch angiostribe or strong forceps is placed on the broad ligament above the ovary and close to the tube and the tube is peeled out of its peritoneal covering and the cut edge of the peritoneum is ligated *en masse* but not including the ovarian artery (Figs. 3 to 6). If the broad ligament has been distended by tumor growth it may be impossible to push back the arteries by a single pair of for





Fig. 1. Diagram illustrating the position of the broad ligaments and the approach for the hysterectomy.

cept and in this case two or even three pairs may be used in one or all the ligaments. In the case of a large tumor, the broad ligament is whipped over the edge of the broad ligament, epiploic on each side with a black thread (Fig. 2) and later unite the ligament with a running suture.

If there has been a prolapse of the uterus, the broad ligament can be whipped over separately as we suggested in case of large tumor and instead of uniting them on the other side, the prolapsed portion of the broad ligament is drawn up through the parietal peritoneum of the abdominal wall external to the body of the rectum muscle and united over them in the central line.

#### ADVANTAGE

The preservation of integrity of entire pelvic circulation especially of ovaries and ligament

The sympathetic nerve and ganglia about the uterus are not traumatized (Fig. 3) preventing shock and subsequent neurosis.

5. The position of the bladder and the ureter is undisturbed and they are not liable to traumatism.

6. The broad ligaments are left in their normal condition to maintain a division of the pelvis into anterior and posterior cavities and to serve as a support to the small intestine when the patient assumes the standing position. In this way the patient is freed from the distressing symptom, backache.

7. The technique removes the chief cause of mortality following hysterectomy while brings in about other advantages, namely, freedom from neurosis, absence of backache and if the patient has not reached the menopause, preservation of the menarche function.

The history of one hundred hysterectomies done after this technique (fifty even at the Cook County Hospital and fifty at the Mary Thompson Hospital) were without a mortality. Later cases have been quite satisfactory. Of the fifty cases at the Mary Thompson Hospital, not even one had reached the menopause and of the ten or so percent are menstruating regularly.

This technique by its avoidance of trauma and with its low mortality ought to increase the indication for hysterectomy and allow the surgeon to leave the patient much freer from pathology than if the usual abdominal technique were employed.

## ELEPHANTIASIS OF THE SCROTUM

BA L NELSON BELL M D TSINGKIANGPU CHINA

**E**LEPHANTIASIS of the scrotum is met at times in all parts of the world especially in tropical and semitropical regions but there is a section in the northern part of Kiangsu province China with a latitude of southern Virginia and northern North Carolina in which this condition is not at all rare. In the past few years 50 or more scrotums affected in this manner have been removed in this hospital by Dr. James B. Woods and the writer has removed several in the past two years.

That these cases are of filarial origin there has been little doubt and to a large extent they have come from localities not greatly separated. Some authors state the infection occurs through the drinking water and that after ingestion the filaria seems to have a predilection for the lymphatics of the genitalia and the lower abdomen. The writer has seen no cases affecting the genitalia of the woman but has seen a great number of cases of elephantiasis of the leg in both sexes.

I will present two cases that have come under my observation in the past two months for any value they may be to others who meet this condition.

**CASE 1.** Male age 35 resident S. Yan. Family history negative. The present illness began ten years ago at which time he noticed a slight enlargement of the scrotum. At that time he may have had a slight febrile reaction but he does not remember it unless associated with an attack of malaria. Since the time he first noticed condition the scrotum enlarged progressively and at present is about the size of a large pumpkin. There has never been any pain and the only complaint

now is discomfort on walking. The penis is completely enveloped in the tumor; the urine trickling out through an opening left as the prepuce was enveloped.

The patient was admitted to the hospital September 13, 1918. Physical examination disclosed a man of normal height and weight but complaining of impaired strength. The heart and lungs were negative. The urine was negative. The blood revealed decided malarial infection.

After admission quinine was administered by the intravenous method. On September 17 the patient was operated on. He was put on table one hour before operation and the scrotum levated to drain as much of fluid as possible.

**Operative technique.** The usual preliminary cleansing of skin is followed by the application of benzene iodine solution and 3% per cent iodine solution. A grooved director is passed up the fold leading from the penis and the point made prominent under the skin over the symphysis and a curved knife is used to slit up this fold to this point. The penis is now opened to view in the bottom of the incision and is grasped with gauze and after leaving sufficient of the mucous membrane is dissected free up to the base of the arch of the symphysis and then wrapped in gauze and retracted up over the abdomen. All bleeding of consequence is stopped with hemostats; the incision packed with hot damp gauze and the second step of the operation is taken up. This consists in making a longitudinal incision on either side and parallel with the original incision and the incisions are deepened and lengthened according to the size of the tumor and the difficulty of finding the testicles. As one incises further into the tumor the consistency is less and less vascular and more transparent and serous.



Case 1. September 1918 and October 16, 1918 after operation.



Case 2. October 3, 1918 and October 29, 1918 after operation.

It may be difficult to find the testicles the best rule being to begin high and follow down into the scrotum. Usually one finds a hydrocele which is incised and evacuated. As the testicle and cord is freed it is wrapped in warm gauze and pulled up over the abdomen care being taken not to injure them by pressure or instrumental traumatism. The next step is to unite the upper end of the three incisions by a transverse incision and two elliptical incisions are made on either side of the tumor uniting behind just in front of the anus. The remainder of the attachment of the tumor is then dissected loose to the perineum and the tumor removed. After removal blood is obtained and the testicle then placed on the perineum in the transverse position by the two elliptical incision forming a cleft fitting a man in which they are contained. The mucous membrane of the penis is then sewed down to the upper angle of the wound and a large incision in which a hole has been made for the head of the penis is applied and returned in place with a T bandage. This bandage is changed often as it becomes very hot and stings.

The case I have just described made an eventful recovery except that several of the stitches at the lower margin of the penis became infected and had to be removed. Recovery was rapid. October 16 patient discharged cured.

Case No. 48. J. H. T. (1871) m. l. f. m. h. f. C. J. I. m. l. h. t. k. t. l. t. t. l. t. f. r. t. t. u. f. h. t. l. l. y. n. d. i. d. k. i. l. n. l. g. m. n. t. l. t. t. m. T. k. t. l. h. a. t. b. k. m. m. t. l. t. h. k. h. d. i. g. b. u. i. f. r. t. t. m. t. h. f. t. h. i. f. t. l. t. h. i. l. l. j. i. k. f. i. t. e. p. a. b. e. t. t. f. u. m. b. e. f. n. f. t. a. t. l. k. f. i. t. m. j. t. i. r. u. d. l. f. a. u. l. f. g. i. h. i. t. u. l. f. i. t. v. i. u. v. t. t. k. b. l. a. t. b. l. d. k. h. i. l. f. t. t. u. m. t. h. j. t. m. j. l. h. f. t. h. d.

m. l. t. t. h. k. h. f. t. h. t. m. o. n. a. l. k. b. t. h. g. n. r. a. l. n. l. u. n. a. i. s. o. d. i. h. b. e. n. g. g. e. l. t. n. l. k. n. T. l. e. t. t. e. t. a. d. m. i. t. t. e. t. h. h. p. i. l. s. i. t. m. b. 6. O. p. t. n. i. f. r. i. t. b. u. i. d. u. p. t. n. t. g. e. n. r. l. c. n. d. i. n. A. l. l. e. m. t. o. s. n. g. t. On O. i. t. 3. t. h. e. t. t. a. p. e. t. d. n. t. h. e. s. t. h. z. b. k. f. i. l. l. C. e. e. c. p. t. t. h. t. h. k. t. n. l. t. l. r. h. t. l. f. i. t. t. h. a. n. g. r. i. b. r. j. a. t. l. t. t. l. o. t. h. d. f. i. t. u. l. f. t. t. i. f. l. e. t. e. l.

The patient made an even more rapid and uneventful recovery than Case 1 and the end result was such that the original operation could never have been questioned.

After blood and serum analysis lymph had been taken from the tumor the one in Case 1 weighed 30 pounds and in Case 2 22 pounds. As to recurrence in this trouble after operation. The writer has seen on cases of recurrence the second tumor being about the size of a grape fruit. Removal was accomplished but with difficulty due to the extreme vascularity. It is the general rule that they do not recur. Their weight is variable and has varied from 10 pounds to 60 pounds in this hospital.

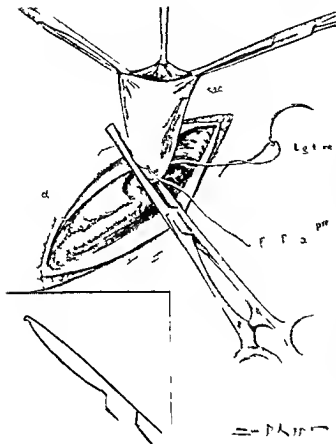
As to the operation itself the technique may be modified to suit the case of the operator. Taylor (Yang h w h) adopted a median incision through the entire tumor the testicle being cut from the innervation of the result in failure. Others have suggested a complete circular incision around the root of the tumor but it is the opinion of the writer that the above technique is preferable for the majority of cases.

The patient and the operation will and we have never had any complication with any of our cases.

The writer has also seen a number of cases of elephantiasis of the leg and has tried the Kono- leon operation with marked success.

## TREATMENT OF THE SAC IN HERNIORRHAPHY

By A. MERRILL MILLER, M.D., F.A.C.S., DANVILLE, ILLINOIS



**H**IGH ligation and amputation of the hernial sac is a point in technique on which most surgeons are agreed.

To accomplish this various procedures have favor with different operators. To be certain the sac does not contain a loop of intestine or tag of omentum the sac is usually opened widely and ligation made under the guidance of the eye. If a patient is straining or distention of the gut is present this may be difficult.

Any mechanical appliance which would add to the certainty and safety of high ligation it seems would be welcome. The Allis pick up forceps is such an instrument and is usually found in the ordinary operating set.

After its application around the sac the smooth spring blades are approximated until the peritoneal surfaces are in apposition. By firm pressure against the abdominal muscles a much higher ligation may be made than by the usual method.

## FRACTURE OF THE NECK OF THE FEMUR IN THE FEEBLE

By WALTER D. WISE, M.D., F.A.C.S., BALTIMORE, MARYLAND

**I**N the past it has been largely the custom in treating fracture of the neck of the femur in the very aged and feeble to treat the patient's general condition and more or less abandon the fracture. About 5 years ago we began to treat impacted fracture of the femoral neck in the feeble by simply putting the patient on a Gatch bed in a modified Fowler position supporting the thigh in the desired position and to abduction and rotation by bandage.

Later we added to this extension by applying adhesive to the flexed thigh making the pull in the line of the thigh leaving the flexed leg free.

The extremity abducted as much as the width of the bed will allow or the patient will stand. If

there is difficulty in maintaining the abduction a modified Runey splint or a simple rod spreader may be used.

A doughnut pad is placed under the heel the back rest may be raised or lowered as desired.

The advantages of the above outlined method of treatment are:

1. It can be applied immediately after the injury even while the patient is in shock thus preventing a certain amount of shortening.

The patient is in a comfortable position and is troubled by no apparatus such as a cast or splint and thus it is possible to give more attention to the skin to prevent bed sores.

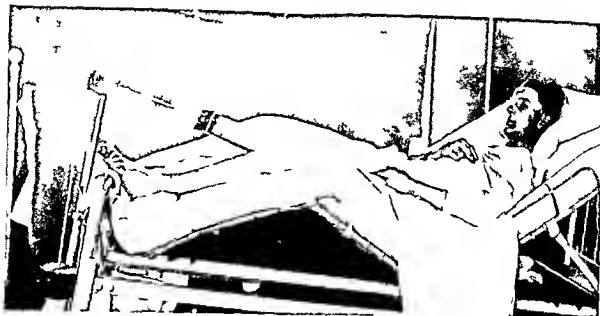


Fig. 1. Patient in supine position, legs held together.



Fig. 2. Patient in supine position, legs held together, head and feet raised.

It is possible to maintain the patient in a supine position for a long time.

4. The immobilization is not complete enough to cause atrophy of the muscles. In getting on and off the bed pain in getting bathed and rubbed there is enough exercise to keep the muscles in a fair state and when the treatment is discontinued there is not the complete absence

of power even after many weeks spent in a cast or plaster.

5. It is easy to get patient on and off bed painless.

6. It can be applied with little or no assistance and can be used in private home.

7. It keeps the patient in a sitting position and guards against hypostatic congestion of the lung and pneumonia.

## CONGENITAL RADIO—ULNAR SYNOSTOSIS

By JAMES WARREN SEVER, M.D., Boston

Fifth Orthopedic Department, Children's Hospital

THE recent report of two cases of congenital fusion of the upper end of the radius and ulnar by Feidt<sup>1</sup> and another by Kopelowitz<sup>2</sup> has led me to report a similar case which has been successfully operated upon. Feidt states that there have been about forty cases reported in the literature with but one case successfully operated upon and the result was obtained then only after five operations.

The condition is apparently an hereditary one generally prone to occur in succeeding generations without any known cause from an embryological point of view. Feidt quoting Lewis<sup>3</sup> states that "that at the sixth week of foetal life the distal ends of the forearm bones were distinct and separated from each other and that the perichondrium of the proximal end of the radius was continuous with that of the adjoining surface of the ulna. Lambertz's law relating to these cases is as follows:

In the extremities the end which shows a less degree of growth hence as the radius does not develop in form it seems to increase in length. This embryological condition may therefore be carried over into full foetal development in some cases especially those with an atavistic tendency.

Clinically the cases present a bony fusion of the upper ends of the radius and ulna not involving the elbow joint and resulting in a lack of ability to supinate. There is some ability to turn the palm of the hand up but only by means of outwardly rotating the humerus. No true power of true supination exists. The bony fusion may cover an area of 3.5 to 6 centimeters in the case reported the distance was 3.5 centimeter. The radius is generally bowed somewhat as well as thickened.

Course of the upper end of the radius and ulna after operation. The elbow joint is normal and the fusion is complete.

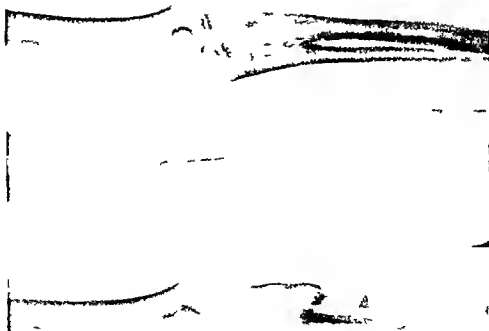


Fig. 1 (top) Anteroposterior view of left arm before operation. Right arm after operation. Not beginning of a humerus to ulna. Fig. 2 Anteroposterior view of left arm after operation.



# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD FRIDAY APRIL 18 1919 AT 8 P M DR N S HEANEY PRESIDING

### OCCURRENCE OF NEW GROWTHS IN LAPAROTOMY WOUNDS

DR W C DANFORTH In the absence of Dr Danforth Dr R A Scott read Dr Danforth's paper on New Growths in Laparotomy Wounds (see p 175)

### PREGNANCY AND LABOR FOLLOWING AMPUTATION OF THE CERVIX UTERI

DR O S FAVLIK discussed the subject of pregnancy and labor following amputation of the cervix uteri (see p 172)

### DISCUSSION

DR C B PEED When my case cited by Dr Favlik came before me it was extremely interesting to find how little literature existed on the subject. At that time I supposed the literature would be quite extensive on account of the frequency with which the operation had been done but I called up several gynecologists here in town — Ries I think among them — and I could not find that any of them had ever seen a case of pregnancy after a Schroeder had been done. This would of course suggest that the sterility in these cases had been underestimated by the men who had reported the cases. I was also surprised to find after Dr Favlik has gone into the matter how little literature exists on the subject. It is an old operation and a common one and it must be that pregnancy has followed or has complicated the conditions that followed the operation.

In my own case the woman went practically to term but I do not know that that would be a common experience. The statistics do not seem to be very sure about it. My own feeling is that the operation of cesarean section in these cases is justifiable on account of the rigidity of the cervix and on account of the danger of tears into and through the upper tissues of the pelvis. Therefore I feel that the conclusions reached by Dr Favlik are very justifiable.

DR R W HODGES It must be ten years since I planned to write a paper on this subject. At that time there was nothing in the literature. About sixteen or seventeen years ago when I became a member of the staff of Augustana Hospital Dr Ochsner discussed with me amputation of the cervix in its relation to subsequent pregnancy and sug-

gested that it would be interesting if we wrote it up together. At that time I looked up a number of our cases and the only conclusion I came to was that the early marks of labor were lost. You could not tell anything about the labor because so much was lost in removal of the cervix. The labor was exceedingly easy and uneventful. At that time I decided that the paper I would write would be to contrast the benefits to be derived from amputation of the cervix with those from repair of the cervix. I think it is a real menace to repair a cervix in a woman who is going to have a baby. The circumference of the cervix is greatly reduced by an ordinary trachelorrhaphy. Therefore if I thought it necessary to do anything to the cervix in a child-bearing woman it should be an amputation and not a repair. I have said over and over again that the rarest abnormality to be found in obstetrics is a rigid cervix. There are sometimes other things that will cause rigidity but when an analysis is made the cervix is found to be not the thing at fault but that there is a minor pelvic contraction.

DR GOLDSBACH I am rather surprised to hear of so many instances as the essayist reports of obstruction to labor from cicatricial development following this operation and likewise in reducing the obstruction to conception. I would declare most emphatically that any such cicatricial development is obviously due to wrong technique poor surgery, an imperfect plastic.

The only reason that I had in mind that might properly be regarded as an objection to amputation of the cervix was the one the essayist alluded to last, namely, that there might be insufficiency of retentive function in the pregnant uterus which invited miscarriage. Now as far as experience goes I should state that I have done a good many amputations of the cervix which were followed by pregnancy and there must be a good many of my cases in the city. These cases afterward were mostly in the hands of assistants of mine so not many of them were out of our reach. The obstetrical cases that followed our combined gynecological work showed that such cases do occur. I do not know that this operation is instrumental in producing abortion. It seems possible that it might produce a premature labor but not so early that a living child might not be delivered. The internal os does not soften until about the last month of normal gestation. The external os will frequently soften up and



become putulous. You can put your finger into that little cup but you strike the internal os. It is generally very near termination of labor before the internal os gives way and the entire cervix becomes a soft tube which will soon relax to be followed by labor. Now if that view of it is correct the internal os holds firm until a time when there is no danger of the baby being delivered. Therefore it is rational to assume that the cervix plays an important role in gestation. To my mind it is not.

Now what is the reason for doing an amputation of the cervix rather than an ordinary Emmett plastic? If the cervix has simply a tear in it which does not extend up into the vaginal canal and the tissues are soft normal elastic and pliable without any induration that lesion is not a pathological entity. It is simply a blemish that annoys the practiced eye that sees it. We may have a pathological induration the outcome of previous infection and inflammation. We may have that without laceration but we have it more frequently following laceration because the laceration furnishes the atrium where the infection nests. Dr. Emmett had the correct idea but I contend that he did not give a clear enough opinion of the achieved end. All he said was that by simply cutting out the pathological cervix with the fear you moved only the irritation which came from that part. You did not remove the irritation which comes from the entire indurated trunk of that cervix nor that which comes from the granulation and inflamed area above the cervix.

When we amputate these cervixes how far up should we go. In children and men I could not go more than half way up to the internal os and would leave at least one half inch. That will take away the tissues that are indurated and lessen the danger the chances of future child birth. In doing this amputation of the lower half of the cervix we remove many of the cervical glands in which infection exists in the glands on follicles. They are not in the cervix at the end of the os but are found in the cervical tissues farther up. It is from these follicles that malignancy comes so by removing at least in the lower half of the cervix we take away more of the irritative element and much of the danger of a later malignancy. But correct surgery must be done and no denuded cysts should be left. Mucous membrane must meet mucous membrane and there must be a perfect plastic.

Dr. Paddock. The gynecologist should know nothing about abortion which can occur in these cases previous to the operation. He laid particular stress upon pre-nancy following the operation. I think Dr. Gollisophon emphasized or at least meant to that the infection which extended to the tissues which need repair has also extended to the endometrium and left it in such a condition that abortion is frequent. I think abortion is due more to that condition than to the result of the operation. Personally I cannot believe that the abortions which occur early are due to the amputation of the cervix.

Amputation can produce premature labor when we have the lower uterine segment forming late in pre-nancy but how it can produce abortion I cannot understand. I recall more than one case in my own practice—I am sorry I cannot give the statistics—where the cervix was amputated and there were none of the difficulties in labor mentioned here tonight. I want to emphasize that the condition which already exists and not the operation is what is responsible for the abortion.

Dr. VAN HOOSEN. I think Dr. Paddock would be interested in a case in which I performed a hysterectomy four weeks ago. The patient had had three children and had never had a miscarriage. After the birth of her third child she was told she had a face at cervix and was advised to have it repaired. After this she became pregnant but never carried the child longer than two months and she lost a much blood that I decided on account of the operation she would probably not be able to have more children. On examining the uterus I found there was only an inch left. I never saw a patient with a uterus that had so little of the uterus remaining. An amputation must have been made above the internal os. I do not believe Dr. Paddock could expect a woman to carry a child to term with a cervix that is amputated above the internal os. If half of the cervix is left I do not think any one would expect a woman to have difficulty in labor but if the amputation is higher up I am sure it could interfere. About ten years ago Dr. Varro continued patient who had a high amputation of the cervix. The woman went to full term and went into labor. I saw her with one or two other physicians in consultation. It was a very difficult labor and both mother and child died shortly after a doctor from Pittsburg told Dr. Varro of a similar case in his service in which the patient died from uncontrollable hemorrhage.

Dr. GLEISTINE. I want to defend a statement Dr. Laik made. Personally I have never seen many abnormalities from amputation of the cervix because we do not run into many Schroeder operations. Where I have run into these it has been with some other plastic work. Very little amputation is done by me because of two statements made by two past presidents of this society. The first man said that no good was accomplished by amputating the cervix in the presence of carcinoma because that statement was made I have left the cervix alone. The second statement was by a man who wanted to know why the scars from an amputation was not just as much of an etiologic factor in causing carcinoma as the original scar. I do not believe we can do very much amputating as a prophylactic measure particularly against carcinoma. Peculiarly my experience in the Dublin Hospital I do not remember seeing a case where dys-toxia was caused from amputation or where a repaired cervix prevented abortion.

Dr. RISS. The very enjoyable discussion that was brought out by this paper seems to indicate

that there is a good deal to it. We hear on one side reports from the literature that amputation of the cervix is a very bad operation and on the other side from the personal experience of one of our members we learn it is not bad at all. There is just the bare possibility that we are not always speaking of the same thing when we speak of amputation of the cervix. It has been stated in the very interesting reports in the literature exactly what kind of amputation was done. The Schroeder method is not the only method which is practiced. There are several others. I have had the pleasure of seeing Dr. Ochsner operate on the cervix only once and what he did was not the Schroeder operation. After the Ochsner operation I see no reason why there should be dystocia or a cicatricial cervix whereas after the Schroeder operation there is another condition. I think the point brought out by Dr. Van Hoesen regarding the different cervical operations as to height is a good one. Of course that will make an enormous difference in subsequent labors. If we speak only of amputation of the cervix and its influence on further pregnancy we have to specify what height of operation we are speaking of.

DR. HEANEY: Amputation of the cervix is a different thing in the hands of different men. If we analyze Dr. Pavlik's paper we will find he has two sets of cases. That must be due to a difference in the kind of method. He made one statement which I do not think he meant that Dr. Reed did the cesarean section as he feared a premature termination of labor. That statement probably needs correction.

The effect upon labor depends upon the amount of cervical tissue that is left and the kind of scar resulting. I have had two patients that have had vaginal cesarean sections done but they failed to heal so there was practically no cervix left. These patients frequently abort. They have bleeding without pain and when a physician arrives he finds the ovum sticking out of the cervix. They have no pain just the ordinary intermittent contraction. One patient who had an incision of the cervix for dysmenorrhea and sterility had a few little pains and then aborted. By passing a sound it was found that there was an incomplete ring to the cervix. We can imagine if the amputation is short it would require a few more pains to dilate the cervix than it would in a patient who has had a vaginal cesarean section with failure to heal and that this patient would probably abort early. I have never confined a patient who has had a Schroeder operation. I have delivered a great many patients that had amputation of the cervix by the Martin method a low operation with just a portion of the cervix removed. I recently delivered a patient for the second time. She had been married eleven years before she became pregnant. She had had a very severe leucorrhœa. The cervix had been dilated twice in order to do away with the cervical dystocia. I did a low amputation of the cervix leaving half of the cervix. The patient very

promptly became pregnant. I delivered her twice and operated on her within two years. In each one of the labors the first stage always was very short two or three hours and the cervix was dilated and not with very much difficulty because there was not very much tissue to overcome.

Now in Dr. Pavlik's paper he speaks about two sorts of conditions arising from cervical amputation. First the patient has an amputation followed by a premature labor or she cannot carry the baby to term or secondly she has an obstruction to the cervix. They cannot be due to the same cause. The first one that had no healing in the amputated cervix was constantly aborting. In the other case she has scar tissue resulting and the cervix dilates with great difficulty. I have one patient on whom I did a Martin amputation of the cervix and if she ever becomes pregnant she is going to have a hard time. She had a hemorrhage on the second or third day and the interne took a wad of cotton soaked it in ferric chloride and picked it in the vagina to stop the flow. It stopped the hemorrhage but she had a slough and now there is a mass of scar tissue in the vault of the vagina. She menstruates with out pain. I think the result upon pregnancy and labors as brought out by the various discussions depends first on the amount of tissue left in the cervix and second on the amount of scar.

DR. HOLMES: It just came to my mind that the expression amputation of the cervix gives a wrong idea as suggested by Dr. Van Hoesen. Literally amputation of the cervix means amputation of the entire cervix. Of course it does not mean that to the gynecologists. I have never done a complete amputation of the cervix except in old women with greatly dilated cervix and marked prolapse. Our gynecological method of cervical amputation never means amputation of the entire cervix. Ordinarily it means about one half of the cervix.

DR. PAVLIK (closing): The point I wanted to bring out was this that if there was poor repair and a great deal of cicatricial tissue abortion would frequently result. According to the literature and according to the personal communications which I have received it shows that about 50 per cent of these women abort.

#### EXTRAPERITONEAL TUMOR COMPLICATING PREGNANCY

DR. VAN HOESEN: The patient was a woman 33 years of age in her first pregnancy. She had asked me to confine her but had not come to the office for examination. One day she telephoned that she was having terrific pain and was advised to come at once to the hospital. At examination I found a large mass in the posterior cul de sac about the size of a very large orange. I thought it was an incarcerated tumor. I called Dr. Yarros in consultation and she agreed that probably the best thing to do would be to wait until the child was

viable. We kept her free from pain and put her in bed in the knee chest position. She had a great deal of pain all along and at the seventh month we decided to do a cesarean section. I opened the abdominal cavity and found that the tumor was not in the pelvis at all but entirely extra-peritoneal. It had no connection with the uterus, ovaries or tubes as far as I could see. I clipped the all men without doing a cesarean section. At the same time while she was under the anæsthetic I put in a retractor and made an incision into the posterior vaginal wall and came upon what felt like a fibroid tumor. While I was trying to loosen the capsule my finger went through into the cavity into the hench as smooth as glass and filled with soft brain-like tissue. When I thumbed my finger this soft brain-like tissue poured out. In a few seconds I had enough material to fill a small pulley. The hæmorrhage so great that it required a half yard of half-inch gauze to stop it. I put a tent as put back to bed. The packing was removed on the fourth day. The next day she gave birth though the vaginal delivery. It evidently had been dead for a day or two because the skin as pretty well off the cotyledon. The patient lived for two weeks after the birth of the child. She did not have a high leucocyte count or a low one at any time.

His tologist's report on the tumor is as follows: It was seen under the microscope by Dr. R. H. who has studied these specimens and I hope will clear them up.

Dr. R. H. Throthelton says of Dr. Van Hoesen: I have been privileged to see me first time and some of the sections. I have seen her mass which is a lobulated like blood clot. There was no structure to be recognized. The tissue I received was about the size of a egg. It was only a small part of the whole mass. The sections which you see here are from the Dr. Lincoln's laboratory. They are characterized by first glance by the important facts: the hæmorrhage, the blood throughout. There is an enormous amount of syncytial tissue. The arrangement of cells was much the same as you see in the normal placenta of a hydatid mole. Besides the syncytial cells the cytotrophoblastic cells of different types. There was no structure that could remind one of the placenta, but it is not necessary for a diagnosis of syncytoma malignum. These tumors are characterized by regular nuclei of decidua cells and Langhans cells.

If we consider that other tumors should be considered as possibly giving rise to these tumors, we are reminded of the giant cell sarcoma. They do not show these irregular growths of finger-like branches of syncytium such as we see under the microscope here. The growth of cytotrophoblastic cells typical of syncytoma originating in the placenta. One might think of a dermoid or a bone tumor but

bone marrow tumors are always accompanied by other suggestions of bone marrow. You find the cells that you find in bone marrow and there is nothing like that in this case. I am at a loss to think of any other origin of this tumor except the placenta. This would make the tumor one of those extremely rare malignant syncytiomata which has occurred during pregnancy and has taken its origin in that pregnancy. It is not possible for the syncytioma to develop from a previous pregnancy, though it is possible for a pregnancy to become superimposed on the syncytioma. I know of only two cases here the syncytioma has been found outside of the uterus during pregnancy. There have been a number of cases here the syncytioma has developed in the uterus or in the fallopian tube during the course of the pregnancy. This is the type of the original cases of syncytioma described in the early days.

This is a very remarkable case. When the Dr. R. H. told me of the case and told me of the location of the tumor under the peritoneum of the cul-de-sac twice the cervix and the ectum I of course as mentioned of those cases of adenomyosis. Dr. C. H. Curtis gave me a beautiful description of the case and which Cullen also has described. Anatomically the structure is very different. There are no glomerular elements and no vascular elements. Before such adenomyomata of the rectum and septum should undergo malignant degeneration and become carcinomatous you still have to deal with glandular elements and none of the histological features to be seen in these sections. It is very unfortunate that it did not get a post-mortem. It would have been a very interesting study of the placental site, the case and placental site to fill up the blood vessels. It would have been extremely interesting to investigate the lungs.

Dr. R. A. Scott would like to know if this tumor had started somewhere in the placenta or could set off something anywhere abnormal in placental tissue.

Dr. H. L. In a question Dr. Scott's question the placenta in these cases may be absolutely normal in one case of which I know they were very placental features in the hope that some woman would develop a syncytioma after a dead and they could study the placenta but it did not work out. In all the cases I know of which the syncytioma developed after a dead and where the placenta had been studied the usual care nothing abnormal had been found.

Dr. Van Hoesen (closing). In answer to Dr. Heney the placenta showed no abnormality whatever. The patient had no trouble with the lungs so enough. It is very difficult to see the movements possibly due to the pressure but other than that she seemed to be no malice except pain which was due undoubtedly to the pressure.

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD APRIL 4 1919 DR THOMAS J SULLIVAN PRESIDING

TRANSPLANTING OF BONE IN FRACTURE OF  
THE NECK OF THE FEMUR

DR CHARLES DAVISON read a paper entitled  
Transplanting Bone in Fracture of the Neck of the  
Femur see p 142

## DISCUSSION

DR WILLIAM HESSERT I did not quite understand whether Dr Davison removes the graft or not In the second place I would like to ask him how he reconciles the action of this case according to Wolf's law If the case goes three years without function why was not the graft absorbed? When a bone is not functioning it is said the graft is absorbed

DR WILLIAM R CUBBINS I would like to ask Dr Davison how he places the graft? Does he drill into the cancellous structure of the head or simply drive the bone in?

DR LML G BFCK Would it not be possible to use the the head of the fibula from another person who has just been killed or one who has just died The enormous method of using a smooth surface of the joint and placing it in the cavity might be developed to a greater extent In a few years almost a normal head may be developed out of a small head of the fibula We have seen regeneration of bone when narrow grafts of bone are placed in a bone cavity and in time it grows almost to the normal size of the tibia

DR DAVISON (closing) In answer to Dr Hessler the capital fragment was taken out in the third case because it was a sequestrum

Again answering him the reason why the upper part of the transplant did not atrophy according to Wolf's law in the third case was that I began passive motion just the moment that I took the patient out of immobilization and she had vigorous passive movements until she was on her feet

The transplant was taken from the fibula on the same side A good deal of investigation has been made by the French surgeons Gangolphe and Bertein on the effect of the removal of a segment of fibula for transplantation on the walking strength of the leg They concluded that it produced little or no harm regardless of the amount of regeneration I have taken my transplants from the fibula of the same extremity so that if I did any injury it would be only to the crippled extremity

In the first and second types of cases I obtain the transplant from the lower superficial part of the fibula beginning two and a half inches above the ankle joint which leaves sufficient bone to retain the mortise of the ankle joint

Some one asked the age of the second patient He was thirty five years of age when operated upon

About transplants from the cadaver those who have studied the effects experimentally of bone grafting have learned that bone transplants graft with the greatest activity when taken from the same individual next best when taken from the next of kin and with diminishing activity as the distance from common origin increases The transplant to graft well must be transferred immediately while it contains the blood and serum of the location from which it came then if it is placed in the bone of the same individual the reaction of the blood and serum of that individual is the same to it as it was in its original location whereas if the bone is taken from another individual that reaction is different Cadaver transplants and heterogeneous transplants graft poorly

In the first case that of recent fracture the transplant was put in to act as a local splint a body which was sterile and not offending to the tissues of the recipient It grafted the parts together and kept the capital fragment alive until circulation was reestablished The capital fragment and the shaft of the femur were stabilized they were grafted together and the circulation throughout was maintained There was no change in the capital fragment in the first case any more than there would be in the smaller fragment if the shaft of any other long bone was fractured and then united in good position

In the second case the transplant was put in with the idea that it would produce a new capital fragment The old devitalized capital fragment was left in place for a framework for the new bone cells to grow into with the expectation that the old structure of the capital fragment would be entirely absorbed that the transplant which is really not the kind of bone that belongs in the location where it is placed would be eventually absorbed It is a foreign kind of bone to that locality and absorption begins as soon as its function is gone It takes some time under the most favorable circumstances to absorb a period of several years In a yearling ram the process is completed in one year

## BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN SURGERY

THE casual reader of surgical texts no doubt is convinced that there is no necessity for another treatise on surgical treatment. Our books are already growing under the stress of large healthy volumes in operative treatment. The student of surgery invariably is disappointed when he seeks counsel that his text is on treatment because so much is left to his discretion. Surgery today is an art the success of which depends on many factors and one of the greatest is that of observation to minute detail. The cause of detail is what makes a great surgeon. The general principles of surgery are known to every surgeon but the ways and means to accomplish his end are often obscure. A most delicate and technical operation may be performed with great skill and yet the omission of a detail may provoke a failure.

It is to the great T of pleasure that th e  
vie er has scanned the pa e of Wa ha se s ne  
treat se frankly at first as a skeptic This treatise  
h ch consists of three olumes s not a wo l on op  
erative surgery but as the title indicates Surgical  
Treatment As the author states in the preface  
his object i to place in the hands of the su geon the  
means for rendering help in every surgical condition  
under all circumstances He reco izes that the  
ideal form of treatment cannot be carried out at all  
times and that the e penced surgeon will under  
take a course of treatment with success which ould  
mean disaster if undertaken by the less proficent  
nevertheless many tmes the less experenc d man  
mu t render aid in the most hazardous risks and  
under the most trvin circumstances It s to the  
mind of the rev er to the faster that this work is  
of the utmost assistance and value

The author has classified his material exceedingly well and there is little duplication or overlapping. Volume I is devoted to the treatment of the general surgical processes such as wound infection, gun, grenade tumors and the like, also diseases of bones, joints, bursa, and fractures. The surgery of the blood vessel and lymphatics is also considered in this volume. Volume II considers the head, spine, neck, thorax, breast, abdomen, and Volume III, hernia, rectum, anus, appendix, liver, gall passages, genitourinary system, pelvis, amputations, the extremities, plastic and cosmetic surgery, electricity and radiation injuries from electric currents, gas poisoning, first aid, and the like. In all this work there are certain elements which are outstanding.

In the discussion of treatment of renal surgery the topic is introduced by a consideration of the surgical anatomy. The reader's mind is first refreshed regarding the anatomy and anatomical relations and embryology then indicated. This is illustrated by many clear and instructive cuts. A brief concise course of treatment is outlined in detail. In many instances this is not operative. When an operation is indicated the ideal operation in the mind of the author is given and the postoperative treatment discussed. Nothing is omitted or left to the imagination of the reader. Formulas are given in detail. The complications are discussed with propriety. If the ideal treatment cannot be carried out for various reasons the possibilities are given. The technique of the various operations are explained in detail. The various standard operations are given in detail as well as the more unusual procedures. The author refrains from a proper nomenclature although he recognizes propriety when it is established. It is not the desirability of the operation which is the meat of this treatise although this is brilliantly done. The true value lies in the minute discussion of every surgical condition as to the nature of the procedure and how it should be treated. The patient's welfare is always the first consideration. One is forced to reason as the author does and see the line of treatment.

The work is certainly a departure from the stye type text on operative surgery. It stands alone in that it has a human element which embues the reader with a determination to help his patient to recover and not necessarily to perform an operative

After reading the treatise there is no surgeon be he experienced or not but will be a more pains taking and courageous student a better surgeon and a greater benefactor to humanity

ALTHOUGH the profession is all in the dark regarding the actual cause of carcinoma yet the enormous amount of work that has been done on malignant disease has brought its treatment to the point where it has done much to teach the surgeon the cellular and characteristics of cancer as well as the manner of treatment so that today a radical operation is almost the knife offers a modest reward for the sufferer. The subject of carcinoma as well as that of all neoplasms grows has a peculiar fascination. The mysteriousness of the disease and at times ravaging course of this type of proliferation of cells never ceases to cause the surgeon to ponder and resolve to know more of it and to live

and cell proliferation. The complete assembly of facts regarding neoplastic diseases as it stands today is most ably set forth in Ewing's<sup>1</sup> new textbook on tumors.

It is amazing to see what he has done not only in America but abroad on the subject of tumors. Every possible clue has been studied with the hope of determining some possible factor which may lead to a definite etiology. A large amount of this work is given in detail with not only the author's version but that of every other authority.

The text is divided into two parts: first a general discussion of tumor formation and especially carcinoma is given. Then a classic description of the different tumors and a description of regional neoplastic diseases. The information seems final for to day.

In no other work known to the reader is there such a fund of information regarding tumors. Every possible angle is discussed, even to symptoms and general lines of treatment.

Carcinoma is discussed from the standpoint of general characteristics, its malignancy, deterring much experimental work that has been done, then a tumor with a description of the different types and finally carcinoma as it may affect different organs and regions with its possible cause, types, course of growth with dissemination, symptoms, and at times treatment.

This work is without doubt the most classic and comprehensive discussion of the subject of neoplastic disease before the profession today and will be for some time.

VERY little has been written on the subject of birth fractures, probably because of the infrequency of the condition. Any one who has had any experience with the treatment of fractures of the femur, humerus and clavicle of a newborn infant realizes that he has a difficult task to perform. The recent atlas prepared by Truesdell<sup>2</sup> is most interesting. He devotes most of the volume to fractures of the skull, femur, clavicle and humerus with epiphyseal separations.

It is well illustrated with X-ray reproductions. The most interesting part is that relative to fracture of the humerus, epiphyseal separation and a number of untreated as well as treated cases are shown with X-ray findings from time to time illustrating the unusual and almost unbelievable processes of repair which not only cause union but soon almost completely efface the deformity.

The atlas is brief in text but extensively illustrated by roentgen illustrations which are most useful not only in diagnosis but in demonstrating the changes which occur from time to time in bone union, the correction or development which occurs in fractures of the newborn.

N M D E T T By J m E ng  
A M M D S D I h I d l p h a d L o d W B d r s C m p y  
9 9  
B m F C T P E P D oc By Edw d  
D Tru d H M D N w Y L I B H o e b e 9 7

THE surgical aspect of gunshot wounds of the abdomen has been considered since the advent of modern explosives. Many times have opinions been changed after apparent definite conclusions have been reached. The recent great war has proved certain definite facts, all of which are clearly stated in the little volume by Wallace.<sup>3</sup> The British during the Boer War had laid down definite procedures in regard to abdominal gunshot wounds. These were radically changed even after the beginning of hostilities in 1914.

In this volume the author classifies gunshot wounds of the abdomen into a working basis giving anatomical considerations, the type of missile and surgical necessities. His deductions are based on sound surgical principles and ring true to conditions as they are met in active warfare. In the preface the author states. This book contains the experiences in abdominal surgery of a sector of the battle line over a period of thirty months. It is founded on the practice of many surgeons working under different conditions and in different hospitals. The personal equation and influence of locality have thus been largely eliminated. It is hoped therefore that the figures quoted may present a standard with which other surgeons can compare their results.

The author tabulate a total of 965 cases giving an anatomical classification with symptoms, pathology and treatment of each. Many conditions relative to gunshot wounds are considered such as distance, type of missile, condition of man when injured, type of warfare indulged in at the time, length of time injured and means of surgical interference. Truly the little volume contains a mine of profitable information and data which are indeed interesting and instructive and many of the principles can be applied to similar conditions in civil life.

A TYPE of wound which is prone to heal and leave a man disabled may when given proper attention from the beginning leave but little deleterious after effect. This we see every day in civil life and such findings were increased a thousand fold in the recent war. Not only the high mortality rate in the first years of the recent war but the thousand and tens of thousands of permanently crippled men bear evidence of this as compared with results during the latter part of the war. Not until definite ideas were formulated and equipment procured could proper treatment be put into action. Mayer<sup>4</sup> in his monograph on orthopedic treatment of gunshot injuries after a ripe and extensive experience abroad places before the profession a goodly portion of the valuable information. He classifies the contents into treatment at the front and at the base hospital. Many injuries if not

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S o A C  
T h O  
W C A M M D T h T r o d Gov I r u By L e  
N C U S A P h i d l p h d L o d W B S d r s C m p y  
9 5



# SURGERY, GYNECOLOGY AND OBSTETRICS

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## THE TREATMENT OF HOUR-GLASS STOMACH

BY A. J. WATSON, M.B., M.S., F.R.C.S., LONDON, ENGLAND

A. J. W. L. S. F. L. O. D. II. P. I.

WITH the more general recognition of the importance of clinical symptoms and the routine use of X rays and opaque meals the diagnosis of hour glass stomach has become greatly simplified the treatment however remains far from satisfactory. A perusal of the more recent literature shows that many forms of operation are still being advocated by different surgeons but whereas operative interference in simple cases of chronic gastric ulcer is followed by some 90 per cent of cures the past statistics available show rather less than 70 per cent of cures in cases of hour glass constriction and it must be remembered that even these statistics are based on a relatively small series of cases and therefore are unreliable. In undertaking any form of operative treatment the pathology of this condition must be kept clearly in mind. With the exception of a few cases due to carcinoma or dense perigastric adhesions and the possibility of an occasional case of congenital malformation one may say that every case of hour glass stomach is dependent upon the presence of a chronic ulcer situated on the lesser curve. The ulcer itself is associated with widespread fibrosis and it is the contraction of this fibrous tissue which has given rise to the hour glass deformity so that in the majority of cases there is only a narrow band of stomach tissue situated along the greater curvature which is free from pathological changes. Moreover it

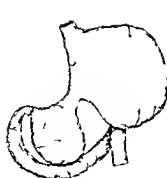
must also be borne in mind that a large proportion of these cases is associated with pyloric obstruction. Whether or not it be true as Rossing<sup>1</sup> believes that the presence of these two ulcers is secondary to viscerosplenic is of no importance for our present consideration the fact remains that not uncommonly the hour glass constriction is associated with pyloric obstruction and the operative technique must be so devised that both conditions are corrected.

There is perhaps no subject in gastric surgery which has led to so much discussion as the treatment of gastric ulcer situated upon the lesser curve but as I shall hope to show in a further communication the evidence is now strongly in favor of excision of the ulcer combined with pyloric occlusion and posterior gastro enterostomy.

Before any operative treatment is undertaken stress must be laid upon the importance of examining the whole of the stomach and attention again directed to the fact that if the hour glass obstruction be situated near the cardiac end the pyloric pouch may be so large that the hour glass constriction is entirely overlooked and an anastomosis between this pouch and duodenum is performed. Such an operation of course would fail to overcome the chief difficulty and is therefore doomed to failure but even if a correct diagnosis of the condition has been

R. G. T. A. S. G. J. 93





I g s and o t t t m s f h s gl  
 ga tr t i my I g o t ble h tr e t x t m v  
 Th t t f th i t h t i t h u h t h m  
 l n n h a t d t h u

Fig. 1. Integral tomography. Part of the hexagonal grid is implemented by a method.

regarded as the one of choice. It is advocated by Sherren<sup>1</sup> and by Paterson who give a series of twelve cases with good results. A loop of the jejunum is taken and a junction made between it and the cardiac pouch as close to the duodenojejunal flexure as possible and a secondary anastomosis made further along the loop with the pyloric pouch. Just as in the case of the single operation considerable difficulty may be experienced in performing a junction with the cardiac pouch and it may thus happen that both anastomoses have to be performed on the anterior surface of the stomach. In addition to these drawbacks there is the fact that a long loop of the jejunum has to be brought up through the mesocolon which will necessitate the making of a large opening in this structure. As a general rule it will be found that the available area in the mesocolon is inadequate for this purpose and that even at the time of the performance of the operation undue pressure may be exerted on the middle colic artery. At a later period the contracting opening will tend to kink the jejunum a danger which will be much greater when there are two junctions. With so large an opening this danger cannot be entirely eliminated however carefully the mesocolon be sutured to the stomach and it is of interest to note that one of the cases reported by

Later on developed intestinal obstruction three years after the performance of the operation. As in the previous operations the actual ulcer is left untouched.

It would seem therefore that any operation to be satisfactory must fulfill two requirements. First it must overcome the mechanical obstruction whether single or double or in other words it must efficaciously drain both cardiac and pyloric pouches. Secondly it must be so devised that it shall lead to a cure of the active ulcer and prevent any complications arising from the presence of such an ulcer. It has been my experience and an experience shared by many surgeons that posterior gastro enterostomy is one of the most satisfactory operations when directed toward the treatment of a constricting ulcer situated at the pylorus but it is insufficient if the ulcer be on the lesser curve and especially so if it be adherent to the pancreas. In such a case not only may the ulcer persist and lead to future symptoms after the performance of an anastomosis but severe and perhaps fatal hemorrhage or perforation may occur at a later date and it is now clearly realized that apparent cure of the ulcer may take place after the performance of the anastomosis only to be followed after an interval of a few years by the onset of carcinoma at the site of the ulcer.

These two entirely different requirements can be met by the following method

Fig 11

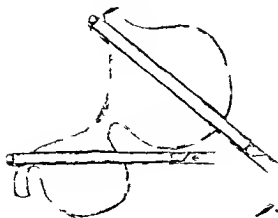


Fig 12

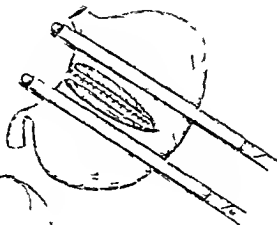
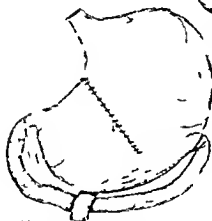


Fig 13



Figs 11, 12 and 13 Author method

Fig 11 Clamps placed obliquely across the stomach. The amount of the stomach wall to be excised is indicated by the dotted line.

Fig 12 Clamps placed parallel to each other. Suture

of stomach opening commenced. The posterior seromuscular layer of sutures has been passed.

Fig 13 Opening in stomach completely closed. Posterior gastro-entero-tomy with horizontal opening performed. Silk suture passed ready to occlude pylorus but not tied.

6 *Partial gastrectomy* In performing this operation the pyloric stenosis the whole of the pyloric pouch and the hour glass constriction are excised in one piece and thus the whole of the diseased area will be removed. This step followed by a Polya method of lateral implantation of the end of the cardiac pouch into the jejunum should always be performed if possible when the constriction is due to carcinoma. When there is no evidence of carcinoma however an operation of this

magnitude is unnecessary and if as is often the case the cardiac pouch be small there may be considerable difficulty in bringing it sufficient far down to anastomose with the small intestine and hence it will not be usually regarded as the operation of choice.

7 *Excision of the ulcer pyloric occlusion and posterior gastro-enterostomy* The theoretical objections to the treatment of a chronic gastric ulcer on the lesser curvature by a simple gastro-enterostomy have already

been mentioned. In actual practice these objections have been found to exist. For this reason it has been my custom for some years to excise the ulcer to occlude the pylorus and to perform a posterior gastro-enterostomy. I shall hope to show in a further communication that with the introduction of these methods which have now been carried out in over 80 cases much more satisfactory results have followed. Hour-glass constriction may be met with in all stages. Sometimes the ulceration is the chief factor the stenosis is light and there are no symptoms of mechanical obstruction. In such instances the treatment is that of a simple ulcer on the lesser curvature. One of my earlier cases was of this nature and satisfactory results followed this line of treatment. Where the stenosis is but lightly more marked a similar plan will naturally be carried out and it is indeed difficult to state at what stage of constriction treatment other than this is required. It seems wiser even where there is marked constriction to carry out the same operative procedure but so to modify the lines of excision that no narrowing of the stomach results. On this line of argument all my later cases were treated by this method with entire satisfaction. The actual steps of the operation are as follows:

In every case of an ulcer remote from the pylorus whether situated on the posterior surface or the lesser curve which from its size is capable of excision a clamp is placed obliquely across the stomach proximal to the ulcer and a second one distal to the ulcer. The posterior blade of each is passed in turn through the gastrocolic omentum beneath the stomach and out through the gastrohepatic omentum. The ulcer if adherent is then freed from the pancreas no notice being taken of the fact that in many cases a perforation into the stomach is thereby caused. A V-shaped portion of the stomach containing the ulcer is now excised between the clamp. In no case has it ever been found necessary to perform a so-called trans-gastric excision. When the diseased area has been excised the opening in the stomach is closed. The two posterior edges are first united by two rows of continuous catgut sutures. The first row commences at the apex of the V and passing through the muscu-

lar and peritoneal coats alone terminates at the lesser curve. The second row begins and ends at the same two points but transfixes all three coats. The two anterior edges are now united in a similar manner the through and through layer being in this case inserted first. The incision must be so planned that the sides of the V are at least as long as the diameter of the stomach. This can be accomplished by making them oblique and when the constriction is very marked the upper limb of the V may terminate almost at the cardiac orifice. With a little care it will always be found possible to make the limbs so long that after they have been united the lumen of the stomach is at least 4.5 inches in diameter. At the same time every care is taken to preserve the band of normal mucosa forming the lower portion of the isthmus. The pylorus is now occluded and a posterior gastro-enterostomy performed. This is carried out in every case even if there is no trace of pyloric stenosis for it has been clearly shown that simple excision of an ulcer on the lesser curve is insufficient. The predisposing cause of the ulceration is not corrected and a fresh ulcer is likely to develop at the line of suture. A gastro-enterostomy alone is also insufficient for with an ulcer in this position there is no pyloric spasm and the stomach contents will continue to pass through the pylorus unless the latter structure be occluded. My own experience however goes to show that permanent occlusion is unnecessary and therefore the canal is obstructed by a simple through and through mattress suture of silk which is sufficient as I have found by post-operative X-ray studies to occlude the lumen for two to three months. A posterior gastro-enterostomy is then performed in the usual manner with clamp and two rows of catgut sutures but in stead of lying vertically it is made transversely and is so placed that its mid-point lies opposite the line of excision of the gastric ulcer. It is for this reason that every care must be taken to preserve the mucosa in the lower part of the isthmus. If a complete segmental gastrectomy had been performed a posterior gastro-enterostomy could not be so placed without dividing the line of suture at the junction. By making the gastro-enterostomy

in this position of the usual length namely about 4 inches long the possibility of constriction at the site of excision is guarded against for although it is unlikely that so wide a canal would ever narrow down yet even if it did the gastro enterostomy would continue to drain both the cardiac and pyloric pouches

The operation is simple in its performance and is not associated with any postoperative shock. In practice it fulfills all requirements and as the following cases will show is efficient in its results

CASE 1. A. H. A married woman age 30 was first seen on December 15, 1913. For 10 years she had suffered with dyspepsia. Her symptoms would come on in attacks lasting from 2 to 3 weeks and then she would be quite well for several months. For the last six months however her symptoms had been continuous. In each attack she would have severe pain in the epigastrium passing through to the back. It would come on two hours after food and would generally be relieved before the next meal. The pain was always severe. In the early attacks there was no vomiting and the appetite was always good. In the last attacks the pain had been much more continuous at the height of the pain she would vomit and this would always relieve the pain. She had lost a great deal of weight and her appetite was not nearly so good. On December 1, an operation was performed the abdomen was opened by an upper right pararectal incision and an ulcer found on the lesser curvature which had led to marked hour glass constriction. The ulcer was excised between clamps the lines of excision being made very oblique so that when the stomach was resutured no line of constriction was left. The abdomen was then closed. She made an uninterrupted recovery from the operation and left the hospital a fortnight later taking a full diet and being free from symptoms. She has remained well and a letter dated May 27, 1919 states that she is now free from all symptoms.

It will be noticed that in this case the pylorus was not occluded and a posterior gastro-enterostomy was not performed. The importance of performing these steps was not at the time recognized and it was thought that a simple excision with restoration of the caliber of the stomach would be sufficient to lead to a cure. Experience of a large number of simple ulcers on the lesser curvature has made it clear that such a procedure is insufficient and further steps must be taken to prevent the formation of fresh ulcers.

CASE 2. N. W. A married woman age 45 first sought treatment on November 24, 1914. For 15 years she had had attacks of stomach trouble such attacks lasting for about a fortnight and recurring at intervals of 6 months. During the intervals she would be perfectly free from symptoms. For the whole period she had been under more or less constant medical treatment but this had no effect in diminishing the frequency or severity of the attacks. In each attack she would have severe pain in the epigastrium and right hypochondrium which would come on about an hour after food. At the height of the pain she would vomit and the vomiting would always relieve the pain. Eight or 9 years ago she had an attack of severe hæmatæmesis but this had not since been repeated. In spite of the pain her appetite remained good.

The last attack had persisted for 10 weeks. The pain had been more severe and had been more constant although it was still increased by food. The appetite had also been failing and the vomiting had been much more frequent. It did not completely relieve the pain and she had lost a considerable amount of weight. On examination she was considerably wasted there were no definite physical signs beyond tenderness in the epigastrium but an X-ray examination after an opaque meal showed a definite hour glass constriction. The test meal showed the presence of 10 per cent free hydrochloric acid and a total acidity of 50. On November 26 an operation was performed and a large ulcer was found on the lesser curvature which was adherent to the pancreas and liver. This had led to marked constriction of the lumen of the stomach. A second ulcer was found at the pylorus which had also caused stenosis. The ulcer at the lesser curve was widely excised the pylorus occluded and a posterior gastro enterostomy performed. The patient made an uninterrupted recovery and was discharged from hospital 16 days later.

In January 1915 she was readmitted to the hospital with a carcinoma of the left breast which was excised. She was quite free from stomach trouble and had had no return since leaving hospital. Since then she has remained free from gastric symptoms. A letter dated May 21, 1919 states that she is able to take all her food well and beyond an occasional attack of diarrhoea is free from all symptoms.

CASE 3. S. P. A single woman age 30 was first seen on March 16, 1914. She had had attacks of abdominal trouble for 20 years each attack would last a few weeks and she would then be free for several months. In the attacks there would be severe pain in the epigastrium commencing about an hour after food. At the height of the pain she would vomit and the pain would then be relieved. On two occasions 10 and 6 years previously she had had severe attacks of hæmatæmesis for which she had prolonged medical treatment.

For the last two years the attacks had been becoming much more frequent and had now become

almost continuous although the pain was less severe. Her appetite had been diminishing, she had lost three stone in weight and vomiting had been much more frequent but did not give the same relief as formerly.

There were no definite physical signs although an opaque meal showed a minute constriction. The test meal showed the presence of 0.5 per cent free hydrochloric acid and total acidity of 41. On March 9, 1916, operation was performed and a ulcer found on the lesser curve of the stomach. The ulcer was closed by the pylorus occluded and a posterior gastroenterostomy performed. She was discharged on March 10 free from all symptoms. Three months later she was able to return to heavy work at a laundry, being free from all symptoms. In June, 1917, she had continued to remain free from symptoms and as doing all her work. A letter dated May, 1919, states that she is still free from gastric symptoms and can eat and drink anything.

CASE 4. A single woman age 31 as first seen on February 19, 1916. She had had attacks similar to those in the last case for years but for the last 6 months had had more continuous pain increased in severity. She had been losing weight and her appetite was poor. The test meal showed the absence of free hydrochloric acid and total acidity of 19. An operation was performed on February 19, and a large ulcer found on the lesser curvature adherent to the pancreas. It was closed by the pylorus occluded and a posterior gastroenterostomy performed. She was discharged on March 10 free from all symptoms. Three months later she was able to return to heavy work at a laundry, being free from all symptoms. In June, 1917, she had continued to remain free from symptoms and as doing all her work. A letter dated May, 1919, states that she is still free from gastric symptoms and can eat and drink anything.

CASE 5. A married woman age 36 as seen on June 5, 1916. She had had symptoms in character with attacks for four years but for the last 6 months they had been almost continuous. During this period she had shown considerable wasting and on examination a round mass the size of an egg could be felt to the left of the umbilicus. An X-ray after an opaque meal showed the stomach divided into two areas united by a narrow canal. An operation was performed on June 7, an hour glass stomach being found. The constriction was about three fourths inches in diameter and showed an ulcerated ulcer at the lesser curve. The ulcer was situated to the pyloric side of the constriction and the constriction on itself was due to a fibrous scar of the old partly healed ulcer. A wide V excision was performed around the ulcer and scar and the edges united. Owing to the space between the stomach and the strain required to unite them silk was used for the posterior layer of sutures. The pylorus was not occluded and a posterior gastroenterostomy performed. She made an uninterrupted recovery and remained free from symptoms until October 2. She was seen again on November 7 complaining of severe pain similar to that before

operation accompanied by vomiting and the test meal showed 0.9 per cent free hydrochloric acid and total acidity 48. She was readmitted to the hospital for a second operation performed. No constriction was found at the site of the old operation but at the lower part of the resection posteriorly an ulcer was found adherent to the pancreas. The stomach was opened anteriorly and in the base of the ulcer was found a portion of the silk suture. A partial gastrectomy was performed and the caudal end of the stomach embedded in the lateral aspect of the jejunum. She has made an uninterrupted recovery and when last seen on March 14, 1919, she was free from all symptoms.

It is interesting to note that in this case there was a recurrence of the ulcer. As is so often the case with gastrojejunal ulcer this was clearly due to an error in technique. Owing to the fear of tension a silk suture was used on the posterior surface a portion of this suture had ulcerated into the stomach and given rise to a chronic ulcer. Since the caudal chronic catgut has alone been used as in all other operations upon the stomach.

CASE 6. M. M. A married woman age 24 was first seen in November 1918. There had been a six years history of attacks which had become more frequent and more severe. She had been wasting and emaciated as increased. The X-ray report showed a penetrating ulcer on the greater curvature of the stomach. Test meal 0.9 per cent free hydrochloric acid and total acidity 45. An operation was performed on November 9 and a chronic ulcer found adherent to the pancreas with a marked hour glass constriction. It was closed by the pylorus occluded and a posterior gastroenterostomy performed. She made an uninterrupted recovery and up to the present date has been free from all symptoms.

CASE 7. A single woman age 34 was first seen on July 3, 1918. She had had attacks of indigestion since childhood. The attacks showed the characteristic symptoms and of late the pain had become more constant but less severe. There had been wasting and loss of appetite.

At operation an old ulcer was found at the lesser curvature of the hour glass constriction. The pylorus was narrowed by scar tissue. The usual operation was performed from which the patient made an uninterrupted recovery and has since remained free from symptoms. The last note dated May 18, 1919, states that there were no symptoms and she was able to take all food well.

CASE 8. L. A. A married woman age 24 first sought treatment on March 3, 1919. She had suffered with indigestion for nine years consisting of more or less continuous discomfort after food. There were however attacks of more severe pain in character with chronic gastric ulcer. For the last six months

the severe pain had been more constant and was associated with frequent vomiting which only in part relieved the pain. At the age of 18 she had several severe attacks of hæmatemesis. The test meal showed absence of free hydrochloric acid and a total acidity of 54.

On March 6 an operation was performed and a lesser curve ulcer with an hour glass constriction found. This was treated in the usual way by excision, occlusion of the pylorus and posterior gastro-enterostomy. The gall bladder was then found to contain a large single stone which was removed and the gall bladder drained. The patient made an uninterrupted recovery but one month later she still had occasional slight pain. This has since improved and although the interval is too short to say that a cure has resulted she is now free from symptoms.

CASE 9 G B A married woman age 2 had been under medical treatment on and off for 5 years. There were attacks of severe pain after food accompanied by vomiting. For 3 months the pain had been more continuous and more severe and the vomiting had been more frequent. During the same period there had been considerable loss of weight and the appetite had not been so good. She was transferred to the surgical department on March 10 1919. Test meal showed free hydrochloric acid 11 per cent total acidity 52. The opaque meal showed a bilocular

stomach with a penetrating type of ulcer on the lesser curvature.

The usual operation was performed on March 13 from which she made an uninterrupted recovery. A month later she was on full diet with no pain or vomiting and was living a normal life.

CASE 10 N P A married woman age 4 had suffered with gastric symptoms for 33 years during this time they had occurred in the characteristic attacks the pain coming on about half an hour after food. The symptoms had changed in the last two and a half years the pain becoming more severe and more continuous. For the last six weeks there had been no relief at all. During this later period vomiting had been more frequent and she had been losing her appetite. Two and a half years ago she had had two attacks of hæmatemesis. On examination there was well marked visceroptosis with splashing over the stomach. The test meal showed free hydrochloric acid 12 per cent total acidity 54. The X ray showed a marked depression on the greater curvature with a bilocular stomach.

On April 10 1919 an operation was performed. A chronic gastric ulcer was found with an hour glass constriction. This was treated in the usual way by excision with pyloric occlusion and posterior gastro-enterostomy. The operation was followed by uninterrupted recovery and she has remained free from symptoms up to date.

## THE TREATMENT OF WAR WOUNDS OF THE JOINTS

BY PROFESSOR PIERRE DUVAL, F. A. C. S.

**A**MONG the different kinds of war wounds there are few the treatment of which has undergone such radical and satisfactory change as has that of wounds of the joints. In 1914 we must admit that very little was known about war wounds of joints and the general regulations concerning the evacuation of the wounded were such that they were sent to the very distant hospitals and when finally the wounded arrived for the attention of the surgeon infection was well advanced.

The radical change that has taken place in the surgical treatment of wounds is due to two related causes: first the fact that the joints resist infection and second the adoption of the practice of operating as early as possible in the lines. The comparative results are as follows:

During 1914 and 1915 in war wounds of the knee the death rate was 7.6 per cent; during the same period amputation of the thigh was done in 30 per cent of the cases. During 1916, 1917 and 1918 the death rate was 0.9 per cent and amputation was done in 2.8 per cent of the injuries. In 1914 and 1915 a soldier wounded in the knee was generally sent either immediately to distant parts of France or operated upon at the army hospital by simple arthrotomy and drainage; from 1916 on such

injuries were operated upon in the lines by complete surgical cleaning and immediate suture. Thus for the practice of late operation and simple drainage was substituted immediate operation and complete closure of the joint.

Immediate suture of a joint that of the knee for instance was done the first time in 1915 by Delore of Lyon; in 1916 during the battle of Verdun it became the general practice of Loubat; it was adopted by Gaudier in the same year and during the battle of the Somme July to December 1916 this practice became the rule. Immediate suture is based on the following principles: a war wound of a joint like any other war wound is contaminated directly by germs which are carried into the wound by shot and fragments of clothing. Infection develops but the defensive reaction of the synovial membrane is much more efficacious than that of other tissues; the synovial membrane seems to possess a bactericidal power. If a wound is examined bacteriologically a few hours after receipt the usual bacteria (aerobes and anaerobes) are found in the skin, the muscles and the aponeurosis. The tissues and the clothing contain a great number of bacteria. If the bones have been injured the surfaces of the fracture are contaminated and the edges



Fig. 1. Result 9 days after operation (1918). Death of the patient.



Fig. 2. Result 3 days after operation (1918). Patient alive.



Fig 3 Result 3 days after operation in shell wound of the knee (1918)

of the torn synovial membrane are also contaminated but the synovial fluid the blood and serum are without bacteria. This aseptic state of the synovial membrane persists for a relatively long time — 48 and sometimes even 60 hours — before the septic arthritis develops. There is then a long intermediate period during which the cavity of the joint remains aseptic while the parasyndovial wounds are contaminated even infected. It is in this intermediate period that operation should be done. On the other hand an appropriate operation permits the excision of all the contaminated tissues even the bone tissue the resection of the contaminated edges of the synovial perforation the removal of all foreign material — the bearers of infection — and it is after this has been done that is when the surgical wound and the joint cavity are aseptic that complete suture with out drainage should be done.

Our bacteriological studies made in the course of the operation have shown the following results. In wounds of the soft parts in the edges of the perforated synovial membrane on the shot and fragments of clothing and on the fractured bone surfaces germs may be found present but the joint fluid is without bacteria.

After operation consisting in excision of the wound of the soft parts the removal of shot and fragments of clothing and the cleaning of the bone at the site of fracture all previous deductions as to the presence of



Fig 4 Result 42 days after suture wound of the calf and knee (1918) The shot entered the calf and lodged in the condyl. Primary suture of the knee and secondary suture of the calf

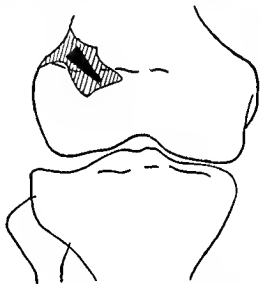


Fig 4a Schematic drawing showing destruction of the joint

bacteria in the wound that is in the muscles aponeurosis bone and synovial fluid have been confirmed by negative results on culture.

Total immediate suture of wounds of the joints preserving the maximum amount of bone surface was adopted generally only in 1917 the year 1916 represented for us a period of hesitation and groping which is easily explained. Early in 1915 under Tuffier's influence typical immediate resection seemed to be the best means of preventing infection of the joint with its fatal results and this





Fig 5 R. lt 7 ly aft st k m d b v f g m n t f h l l (98)



Fig 6 R. lt 8 days ft tr g h t o d of the k (98)

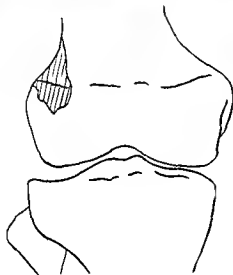


Fig 1 S h m t l h g l t t t



Fig 6 S h t d g h d e t r u t of

practice we must acknowledge saved many lives. Then a few surgeons advised as a measure of safety closure of the synovial cavity without suture of the wound of the soft parts others the introduction of a drain in contact with the closed synovial membranes and others total suture but to make a drainage opening either at the site of the suture or on the summit of the *fossa subcutanea* of the knee.

All these measures called safety measures were soon found to be unsafe measures and total suture of the whole wound was gradually found to be the least dangerous practice. At first the immediate results were

excellent but the surgeons farther back from the line soon warned us of functional results which were termed by them a unfactory stiffness of the joints partial ankylosis etc.

The Lyon school practiced then most energetically immediate typical joint resection not according to Tuffier's idea to prevent joint infection but to obtain better functional results. May I be allowed to say that I have been one of the more ardent advocates of that doctrine?

Total immediate resection must be done only to smooth out very serious injuries of one or both bones of a joint when the injury itself has really accomplished resection.



Fig 7 Result 13 days after suture in wound of the knee made by shell fragment (1918)



Fig 8 Result 52 days after suture in wound of the knee from fragment of shell

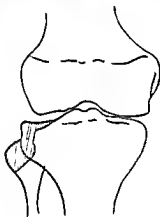
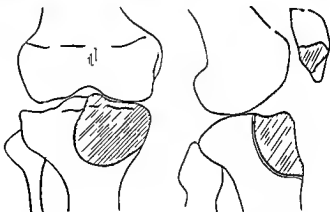


Fig 9a Schematic drawing showing destruction of bone



Figs 9a and b Schematic drawings showing destruction of bone

In war wounds of the joints the utmost must be done to save the limbs. If through misfortune the functional result is bad a secondary economical resection can be done at a later period. The gradual development of a better technique permitted saving fragments of bone which were useful in the anatomical reconstruction of joint surfaces. At the elbow a partly detached condyle has been preserved and put back in place. At the knee fracture of the patella has been regularly treated by suture of the bone and the same is true of fracture of the olecranon at the elbow. At the ankle joint the astragalus has often been partly preserved. At the knee in short condylar fractures of the femur and tibia have been treated conservatively and even by immediate wire suture after complete cleaning.

Functional results have rapidly improved. The patients operated upon have been sent on

to special hospitals for mobilization of the joints. The adoption of the method of Willem of Ghent — active mobilization immediately after operation — has really improved in a great measure the functional results of early operation upon joints.

In 1917 and 1918 the surgical treatment of war wounds of the joints was based on the following principles:

1. Operation as early as possible

Complete operation — that is removal of all foreign substances — total excision of the track of the missile.

2. Careful cleaning of fractured surfaces — complete suture of joint without drainage

3. Active and immediate mobilization

Preservation of parts to as great an extent as possible — immediate resection being limited to injuries with extensive comminution.

The technique varies with each case according





Fig 11 Result 18 days after suture in wound of the elbow from fragment of shell (1918)



Fig 12 Result 23 days after suture in wound of the elbow made by fragment of shell (1917)



Fig 11a Schematic drawing showing destruction of bone



Fig 12a Schematic drawing showing destruction of bone

shoulder and the wrist the incision varies with the size of the wound

The treatment of limited bone injuries is the capital point of the technique. Limited injuries in which there are fragments of shell are treated by ablation of the foreign bodies and careful cleaning of the joint cavity. Bacteriological observation shows that after cleaning the bone tissue is without bacteria.

The bone tissue infiltrated with blood must not be cleaned too vigorously. When one operates at the most opportune time that is 8 to 12 hours after receipt of injury the cleaning must be superficial. An important question to decide is whether a bone cavity which

continues to bleed more or less should be left open in the joint. When the bone injuries are lateral and at the same time are extra articular or intra articular by proper suture of the synovial the cavities are separated from the joint.

But what is to be done in other injuries? Experience shows that these bone cavities well cleaned can be left open in the joint. Some surgeons have obtained successful results by filling the cavities with wax or compact aseptic substances. Often I have filled the cavities with a muscular bit of flesh pedicle which acts as a hemostatic agent. All these methods are good.

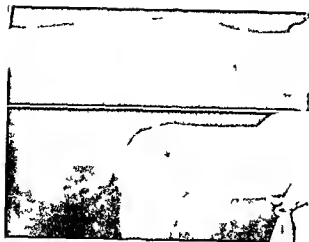


Fig. 3. Result 8 days after treatment of elbow fracture (98).



Fig. 4. Result 10 days after treatment of elbow fracture (98).



Fig. 3. Shunt in the joint.



Fig. 4. Joint in the joint.

When the bone injury is complicated by the presence of fissures more or less extensive the treatment must be the same as for all fractures. After scraping the center of the fracture the fissures must be opened with a lever of any kind so as to scrape the walls of the fissures. Then the bone fragments thus displaced must be replaced. If the bone fragments cannot be correctly maintained in place so as to reestablish the joint surface as much as possible, one may or must resort to nails or screws. This must be done in injuries to the condyles of the femur, of the tibia, of the humerus or of the deep part of the patella.

Once the joint is well cleaned we have a surgical aseptic wound and the operative procedure must be the same as for a closed fracture of a joint.

The most important result to be obtained is the reestablishment as far as possible of a normal joint outline. Experience has shown that good functional results can be obtained even when there is a partial loss of joint surface if the general outline of the joint surface has been preserved. The series of roentgenograms and diagrams which are published here prove this quite conclusively.

The treatment of perforations of the synovial membrane is important. Usually the edges of the synovial aperture are bruised, lifeless from trauma and contaminated by bacteria from the wound. Therefore it is necessary to treat them as we do all war wounds: first by excision and then by suture. Personally when I do a U arthrotomy I begin the operation by excising the damaged tissues of the synovial in lateral arthrotomy. I



Fig 15 Result 9 days after suture in gunshot wound of the elbow (1918)

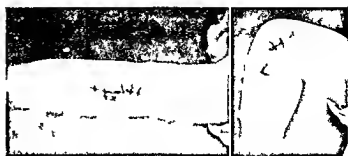


Fig 16 Result 11 days after suture in wound of the elbow caused by fragment of shell (1918)



Fig 15a Schematic drawing, showing destruction of bone



Fig 16a Schematic drawing, showing destruction of bone

start from the outside of the wound and work toward the joint

The treatment of the serous fluid in the joint is most important. The serous liquid must be dried up as completely as possible with dry sponges in all parts so as to leave neither blood nor fibrinous coagulum. This is so important that at the elbow I do not hesitate to section the external lateral ligament.

Up to 1918 before placing the last suture almost all surgeons poured ether into the joint and rubbed the surface of the bone with a sponge saturated with ether. By degrees this

antiseptic treatment has been abandoned and joint surgery has become purely aseptic.

The terminal suture is made layer by layer preserving as much as possible the ligamentous fibrous and muscular planes periarticularly. No drainage is used.

War wounds of joints are frequently accompanied by extensive muscular periarticular destruction. It is most important to repair grave injuries to the important muscles. There are two muscles for which this repair is of first importance—the arm triceps and the thigh quadriceps extensor.



Fig 17 Results 37 days after suture in wound of the elbow by fragment of shell (1917)

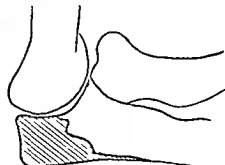


Fig 17a (at right) Schematic drawing showing destruction of bone

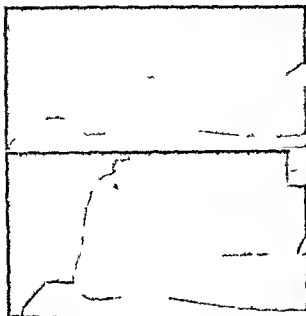


Fig 8 Result 3 days after treatment of the joint (thick line) (nt 1108)



Fig 9 Result 3 days after treatment of the joint (thick line)



Fig 8a Shunt drainage of the joint (thick line)

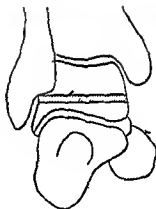


Fig 9a Shunt drainage of the joint (thick line)

During 1917 and 1918 my fellow workers and I practiced immediate muscular and tendinous autoplasties. Our results were very good. In traumatic destruction of the olecranon repair of the triceps by autoplasty and reimplantation on to the olecranon are absolutely necessary.

The after treatment has passed through various phases. Joints thus operated upon were first absolutely immobilized in plaster apparatus for two or three weeks. This period was later shortened to a few days duration.

The method of Willems of Ghent is now used. Active immediate mobilization of joint injuries insures ultimate perfect functional results even in cases of comparatively extensive bone destruction. We must acknowledge that this method is a real step forward in joint surgery.

Those who have watched the continual progress which has been made from 1916 to 1919 say that they can conceive no limits to the results which can be obtained from aseptic surgery of joint wounds. In the last



Fig 20 Result 25 days after suture of the extensor tendons in severe wound of the astragalus (1918)



Fig 21 Result 1 day after suture of gunshot wound of the astragalus and calcaneum (1918)

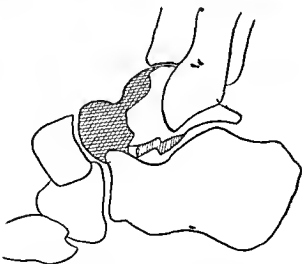


Fig 20a Schematic drawing showing destruction of bone



Fig 21 Schematic drawing showing destruction of bone

German offensive the inevitable delay in bringing in the wounded delayed their removal to the hospitals 24 to 36 hours. But still joint surgery gave good results.

What then are the limitations of this aseptic and preserving surgery of joint wounds?

It is advisable to examine them first as to the length of time elapsed between injury and operation second as to injuries to bones which can be treated by preservation. According to the rule 4 or even 36 hours after injury joint surgery may be applied. Some





Fig. 2. Schematic drawing of the condition of the knee joint after the operation.



Fig. 2. Schematic drawing of the condition of the knee joint after the operation.

times at this time but often later one may find the following condition: a swollen knee which is painful and on incision a suspicious liquid which on examination is found to contain bacteria and few or no injuries to the bones. In such cases what is the best method to use? Joint drainage brings disaster. We have all reached the same conclusion: that even in these doubtful cases it is best to follow the same technique: to suture the joint. If purulent arthritis develops early resection gives excellent results. Personally in cases of arthritis with anaerobic germs I have obtained cures by injecting into the joint

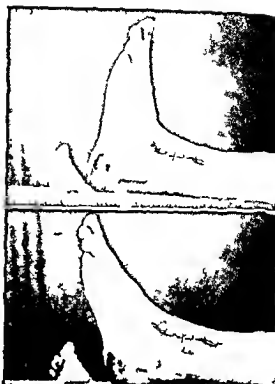


Fig. 3. Schematic drawing of the condition of the knee joint after the operation.



Fig. 3. Schematic drawing of the condition of the knee joint after the operation.

antimicrobial serum. Unfortunately we have nothing with which to combat the streptococcus.



Fig 24 Result 8 day after suture in wound of the fibula and astragalus (98)



Fig Result 13 days after suture in gunshot wound of the astragalus and fibula (1918)

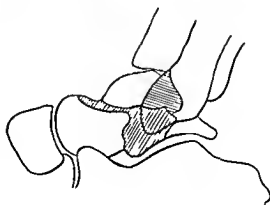
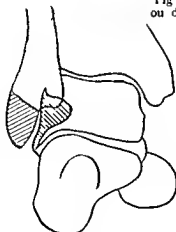
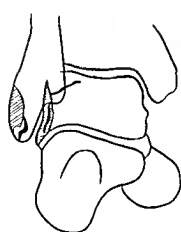


Fig 25a Schematic illustration of bone destruction of bone

Figs 25a and b Schematic illustration of bone

What is the limit of preservation in epiphyseal fractures. One may say that in a general way all fractures must be treated with the idea of preserving the epiphyses at any cost.

When trabecular fractures are complicated by fissures one must still attempt preservation

for it gives fine results but in case of failure it is better to practice early resection. At the elbow or at the knee should a fissure develop on a condyle the fragment of bone must be replaced after cleaning. One of my pupils Gather has even replaced a femoral condyle which had become completely detached he



Fig. 1. Left knee joint after total knee replacement. (1) Right knee joint.

took it out of the joint, cleaned and replaced it - a real immediate graft - and the functional result is good.

Immediate resection must therefore be practiced only exceptionally in cases of serious fracture of the joint surface. But if a rather



Fig. 2. Right knee joint after total knee replacement. (1) Left knee joint.

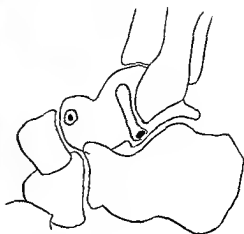


Fig. 3. Schematic drawing of the knee joint showing the position of the femur, tibia, and patella.

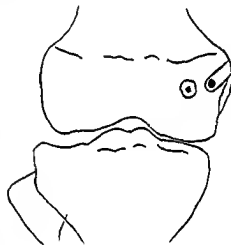


Fig. 4. Schematic drawing of the knee joint showing the position of the femur, tibia, and patella.



Fig. 5. Schematic drawing of the knee joint showing the position of the femur, tibia, and patella.



Fig 28 Wound of the wrist by fragment of shell  
Result after 10 days (98)

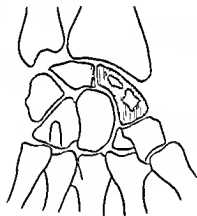


Fig 28 Schematic diagram showing destruction of bone

during attempt at preservation has been made and if one foresees a failure resection must be done at once as a corrective operation.

All injuries to joints must be treated according to these general principles. In the hip only is it thought advisable to do resection directly. At the elbow wrist shoulder knee and ankle aseptic and highly preservative surgery gives extraordinary results.

The series of photographs included in this article shows next to the functional result how extensive were the bone injuries treated

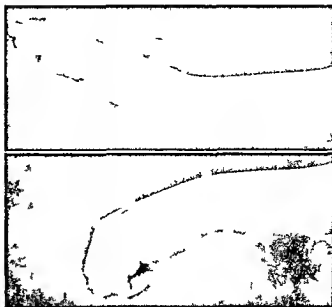


Fig 29 Result after 32 days in gunshot wound of the wrist (1018)

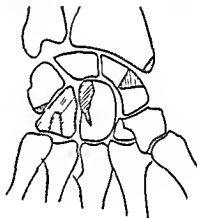


Fig 29 Schematic diagram showing destruction of bone

To give a general idea of the revolution which has taken place in joint surgery during the war I append my personal statistics. During 1915 war wounds of the knee were treated in the lines by arthrotomy and drainage and cared for in our territory with a death rate of 75 per cent. Amputation of the thigh was done in 30 per cent of the cases. During 1916, 1917, and 1918 war wounds of the knee were treated in the lines by total surgery and extreme preservation. In 130 cases there were 11 immediate resections with 4 deaths. Resection was not done in 104 cases. There were 86.5 per cent complete cures, 9.6 per cent comparative failure, 8 per cent amputations, 0.9 per cent deaths.

# THE TREATMENT OF METASTATIC CARCINOMA OF THE SPINE BY DEEP ROENTGENTHERAPY

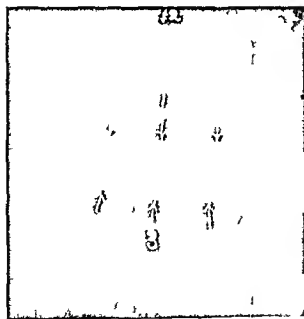
WITH THE REPORT OF FOUR CASES AND REMARKS ON PRE OPERATIVE TREATMENT OF CARCINOMA<sup>1</sup>

I. GEORGE I. PLAMMER, M.D. PHILADELPHIA

THE object of this paper is to prove that deep roentgentherapy will bring about a healing process in deep seated carcinoma. Every one will acknowledge that metastatic carcinoma of the spine is not a superficial disease. It is not the object of this paper to recommend roentgentherapy in the treatment of such advanced carcinoma. It is my belief that when metastatic carcinoma of the spine has developed we are dealing with the beginning or with a part of a general carcinomatosis and not with a localized area of disease. It is also my belief that when one has general carcinomatosis to deal with in which there is a local manifestation giving rise to most of the symptoms one can influence this local disease but we can not expect to get the patient really and per-

manently well by any means that we know today. The life of the patient can be prolonged and made more comfortable but later some area in the body which has escaped treatment or has been unsuccessfully treated will make itself manifest.

The second object of this paper is to encourage the use of the roentgen rays in the early treatment of carcinoma by proving that a favorable and curative effect can be produced upon carcinomatous tissue even in an advanced stage and if this fact is proved there should be no other proof needed to establish this form of treatment as a method of choice in the early treatment of carcinoma. By this I do not mean that we should replace surgery or that we should replace any other method that has been proved efficacious in



I g C 4 h g m p l t e d e t r u t n f t h  
e c d l m b r t b d t m e t t t r m  
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p o t h b t P a t t h d b b d f t t h r m n t h  
R l b e f t h l m g f h E t m R

F C s e 4 h o g o d l m b t b r a h l e d  
d e l f i d T h p t t i f r f m y m p t m s h a  
g d 3 p o u d g h t d d o e a l l h g a l  
f s e w k i n c l d a h g d g  
l g t A l l C y j u a r v t s a

the removal of the disease but I do most earnestly wish to discourage the practice of waiting for the use of the roentgen rays until general carcinomatosis has taken place or until metastasis has taken place or until there is an extensive recurrence following operation. All of the cases of metastatic carcinoma of the spine which I am about to report had primary carcinoma of the breast.

*Ante operative treatment* It is my opinion that the ideal method of treatment of carcinoma of the breast or carcinoma elsewhere in the light of our present knowledge consists of a thorough course of X ray treatment preceding the operation in which the disease is treated from every angle and in which the lymphatic areas draining the breast are included in this ante operative treatment. Within a few days or as soon as it can be practically arranged after this preliminary course of X ray treatment I believe that a complete operation should be performed. Then following this operation at the end of four weeks from the time the first course of X ray treatment was given a second or postoperative course of treatment should be given and these courses of treatment should be repeated at intervals of a month or more. Three to eight such courses or series of cross firing will suffice a general average is about five. In this way I believe the best possible results and the greatest number of cures of carcinoma can be obtained. Whenever it has been possible during the past two years or more I have carried out this plan of treatment.

This ante operative treatment is based not only upon clinical observation but upon experimental work. Colwell and Russ<sup>1</sup> and Nogier, Jaubert de Beaujeu and Contamin<sup>2</sup> have shown the direct effect of the X rays upon the cells of an adenocarcinoma of a mouse. The tumor upon removal from the animal was minced and then exposed to X rays after which it was inoculated into normal mice to see whether it would grow. A typical example showing how the subsequent growth is interfered with is shown by one of their experiments in which fifteen mice were

inoculated with the tumor tissue which had been exposed to the X rays and in which 50 per cent of the rays were absorbed by the tumor tissue. Of these fifteen mice inoculated by this tumor tissue there were no positive results and there were fifteen negatives. Of the control fourteen were positive and one negative. From these observations the author concludes that the rays hinder the subsequent growth of tumors when inoculated. With less absorption of rays there were more successful inoculations. In addition to the decrease in the number of successful inoculations there was a reduction in the rate of growth of the tumor even when inoculation was successful. Marie Clunet and Raulot Lapointe<sup>3</sup> in a study upon the heredity of the characters imposed upon tumors when they are exposed to the X rays selected a sarcoma of the mouse a rapidly growing tumor of a high degree of malignancy with extremely stable histological features. A mouse bearing the tumor was exposed to a strong dose (30 H) of unfiltered X rays and five days later the animal was killed and portions of the tumor grafted into a number of mice when this irradiated graft had grown to a suitable size one was selected and submitted to the same dose of X rays and five days later portions of it were again grafted into a number of mice. In this way the irradiated tumor was kept growing for twenty months and the new characters imposed upon it by the X ray were thoroughly established. These new characters were found to consist mainly of (1) a reduction in the percentage of successful grafts (2) a reduction in the malignancy of the tumor (3) a slower rate of growth and certain histological features of which the following were the most important: (a) the presence of giant cells some cells being as much as four or five times their original diameter (b) atypical mitoses (c) basophile giant cells having multiple nuclei. This shows a gradual reduction in the malignancy of the cells and their power to reproduce themselves even under most favorable circumstances and even with the most malignant type of cells. This is additional experimental evidence in

favor of both ante operative treatment and postoperative treatment

Colwell and Puss also refer to the excellent researches made by Clunet and Paulot Lapointe which researches are reported in detail in Clunet's *Tumeurs Malignes* (1910). In these researches the author has adopted the following procedure. He treated the malignant condition with the X rays and at various stages of the treatment obtained portions of the growth for histological study. As a result of observations of this nature upon nineteen cases of squamous cell carcinoma of malpighian type in the human subject they state that before the ultimate disappearance of the growth the cells pass through at least five successive phases which are characterized as follows: (1) the latent phase (2) development of monstrous characters (3) keratinization (4) disintegration and phagocytosis (5) formation of the connective tissue scar.

1. *The latent phase* varies from six to fifteen days and during this time no cytological changes are to be seen. Its duration is rather shorter for carcinoma of the spinocellular type than for the basocellular type.

2. *The development of monstrous characters* is marked by: (a) an enlargement of all parts of the cells which may be increased in diameter as much as two or three times; (b) an increased number of atypical mitoses; (c) the appearance of enlarged nuclei markedly chromophile and (d) the appearance within the cells of forms having a pseudoparasitic character.

*Keratinization* may be either disseminated total or atypical. When disseminated each cell undergoes keratinization independently of its neighbor in contrast to those effects appearing to influence all cells alike. When atypical keratinization is observed the protoplasm becomes granular at first orangeophile and finally eosinophile; these granules gradually fuse together into one mass of keratin and altogether they are probably similar in their chemical constitution to eleiden. They do not give the same color reactions as this substance.

4. *Disintegration and phagocytosis*. The disintegration of the degenerating cells

appears to be caused mainly by the polymorphous cells and the fibroblasts of the stroma which are in an active condition. Macrophages and plasma cells appear at a later stage and accumulate around the vesicles remaining in the vicinity long after the disappearance of the malignant cells.

5. *Formation of connective tissue scar*. As a general rule this is not brought about by the formation of fibrous masses but the tissues assume the structure of healthy skin except for the absence of hair and of glands; the elastic fibers are also less numerous and more attenuated than they are normally. No neoplastic masses are to be found in these supple scars which appear to be quite healthy. On the other hand at a depth below the skin cells may be found which have been acted upon by the X rays but are not yet destroyed. Such cells remain in a latent condition and if the treatment is not continued they give rise to recurrences.

#### REPORT OF CASES

I shall make a report upon four cases of metastatic carcinoma of the spine in 11 of which there was undoubted destructive disease due to the carcinoma and in which I have been able to demonstrate by roentgenogram not only the disease but the healing and healed process. Symptomatically the patients have shown either marked improvement or complete recovery.

CASE 1. Mrs. B. age 35 came to me September 19 1913. She had been operated upon August 10 1910 by John B. Deaver for carcinoma of the right breast (confirmed by pathological examination). The patient said that she had had in all four operations for three successive recurrences. September 1 at the beginning of my treatment the entire operative area on the right side was studded with nodules which were firmly adherent. These extended to the axilla and in the right axilla there were masses from one half to three quarters of an inch in diameter firmly binding the tissues. There were large nodules in the supraclavicular region on the right side. The left breast contained a mass of tumor tissue with extension of the nipple with metastases in the left axilla and in the left supraclavicular region. There were two small nodules in the left side of the scalp. About three inches of the left second rib and a small area in the third rib on the left side was destroyed and about an arch and a half of the right tenth rib together with

disease of the eighth ninth and tenth dorsal vertebra the fifth lumbar and the upper part of the sacrum There were also distinct deposits in the lungs

Ordinarily such an extensive distribution of disease would preclude even the thought of accomplishing any good results but this patient had an unusual amount of determination to get well Therefore I decided to see what could be accomplished All parts of the body not including the extremities received treatment and as much cross firing was used as was possible She received an enormous amount of treatment during a period of approximately eighteen months and during this time 37 doses averaging about 15 r or amounting to about 3 355 r in all As the result of this treatment she gained 17 pounds in weight she gradually became able to look after her household duties and to do all her housework All of the nodules on the right side of the chest disappeared as well as those in the right axilla and the right supraclavicular region The mass in the left breast had shriveled and while there remained considerable retraction of the nipple the area felt like fibrous tissue and was freely movable The metastasis in the left axilla and supraclavicular region had disappeared The disease in the second rib had entirely healed The disease in the vertebra showed evidence of healing The disease in the third rib and the tenth rib had healed and there was an increase in lime deposit which was evidence of healing in the fifth lumbar and in the sacrum At the end of two and a half years she was free from symptoms excepting dyspnoea During the succeeding six months she began to fail the dyspnoea became more marked and an examination of her chest on September 1 1916 showed an extensive fibrous process throughout both lungs with retraction of the diaphragm upward a general contraction of the lung area and an examination of the extremities showed extensive metastatic carcinoma in all of the long bones She died November 7 1916

This patient therefore was suffering undoubtedly from an extensive metastatic carcinoma at the time of her first visit Over the areas treated by the roentgen rays the disease healed The patient regained a reasonable amount of health was able to assume her household duties and remained free from most of her symptoms during a period of at least two years She probably had her life prolonged for a period of at least two years during which time she lived in reasonable comfort It illustrates however the statements made in the introduction to my paper that these cases are examples of a general carcinomatosis and that ultimately we may expect the patient to die of carcinoma even

though there is a period of reasonable comfort and freedom from symptoms It proves quite clearly the healing process of the roentgen rays It is interesting to note that the disease of the bones in the area treated showed no progression It is also worthy of note that despite the fact that this patient received an enormous dosage over a period of 18 months covering the entire body and all the viscera during which time the blood making organs must have received much treatment the patient continued to improve and the disease disappeared

It seems to me to be a strong argument against the fact that we must depend upon a lymphocytosis for the healing of carcinoma or that prolonged x ray exposure will reduce the lymphocyte and thus interfere with healing It is likely that the discrepancy between Murphy's experimental work and this work upon the human subject is due to the fact that with small animals the entire body is exposed to the rays at once while in clinical work we only expose a small portion of the body on any one day

CASE 2 Mrs I age 34 was referred to me by L H S DeWitt on November 5 1915 On July 18 1914 she had been operated upon for carcinoma of the right breast by Lyman of Grand Rapids Michigan Six months later the patient noticed recurrent nodules in the scar One year after the first operation on the right breast Dr DeWitt removed recurrent and metastatic nodules from the operative field and also removed the left breast on account of carcinoma At the time of my examination November 5 1915 she had two nodules in the right supraclavicular region size three fourths inches disease in the upper medians tumor disease of the head of the left humerus and in the head of the right humerus disease in the left eighth rib disease in the fifth dorsal vertebra disease in the right glenoid cavity and the upper sacrum She also had pains radiating down and along the right thigh and tenderness over each of these points At the end of a month there was some distinct improvement her general health had improved the metastatic nodules had definitely decreased in size and there was some evidence of distinct healing process in the diseased areas of bone This patient improved during the first three months then conditions became rather stationary for two months more and then the disease showed distinct evidence of progression and treatment was discontinued

She died August 4 1916 or approximately nine months after beginning treatment



CASE 3 Mrs M age 52 was referred to me by Dr VanLennop April 8 1906 She had had her right breast amputated by Charles Noble in 1905 or 11 years previously and had no local symptoms or evidence of recurrence during these 11 years In fact she had no evidence of metastasis anywhere until about three months before coming to me she fell down stairs injuring the back of her neck This was followed by a neuritis pains in the head and a distinct swelling on the back of the neck My examination showed almost complete destruction of the entire cervical vertebra so that the patient's head seemed to be supported on a mass of soft tissue The entire cervical vertebrae were found decalcified and disorganized There was also evidence of disease in the upper portion of the chest and disease in the fourth fifth and the eighth dorsal vertebrae She had received in all 165 doses during the first year Since then she has received no treatment At the end of six months the vertebra which had been almost totally destroyed had almost totally recalcified or healed The patient was able to go about her usual affairs as able to travel from place to place on rather long journeys and was having a reasonable amount of comfort in life During the fall of 1911 or about eighteen months after beginning treatment I found her upon the boardwalk at Atlantic City with a pulse of 20 In every other respect she seemed to be in comfortable condition and free from symptoms I ordered her placed in bed under the care of her family physician and she has been under his care ever since I received a telephone report from her on September 3 1911 high time her heart condition had very much improved and none of the other symptoms referable to the spine had recurred

This patient therefore showed a most pronounced healing effect of the diseased areas in the spine This has been persistent and so far as the carcinoma is concerned has been successful over a period of almost three years It is entirely likely that sooner or later the disease will make itself manifest and the patient will take the usual course as a result of general carcinomatosis

CASE 4 Mrs N P age 43 referred to me by C C McCormick March 2 1918 This patient had been operated upon in August 1909 by Deaver for carcinoma of the left breast and received no postoperative X-ray treatment In fact none of these patients which I am reporting received any postoperative or anteoperative X-ray treatment I do not mean by this that if she had received anteoperative or postoperative treatment she would have avoided the complications of metastatic disease that developed for I believe that in most of these cases if not all the metastasis has taken place before the operation In this case the operation took place in August and in December McCormick

wrote me telling me that she was having excruciating pain in the spine and extending down the legs and that she was bedfast At that time the weather was bad and I wrote to him that she undoubtedly had metastatic carcinoma of the spine and since the patient was bedfast it was not in her to take her away from home simply to die I heard nothing further until March when McCormick sent her down to the Medical Surgical Hospital for examination and treatment This was against my advice and against my better judgment for I must confess that I do not like to treat these patients in which the disease has become extensive even though occasionally one gets well or gets freedom from symptoms for ultimately they die of the disease

At my examination I found no evidence of local recurrence over the operative field but I found disease with total destruction of the second lumbar vertebra together with disease of the ninth dorsal vertebra The disease of the second lumbar vertebra gave the usual angular deformity which is found when the body of the vertebra is destroyed At the time of my examination and at the time of beginning treatment she had been bedfast for fifteen weeks

Under X-ray treatment and with the assistance of a brace to give her spine support for her body she was able to get out of bed Gradually there was a recalcification of all of the diseased vertebra and at present she can go about without any brace though I have not given permission to do this She can bend her spine in all directions she has the appearance of perfect health she has gained 30 pounds in weight and is able to do her washing and ironing and her general housework and so far as symptoms act as a guide to us she has recovered completely

She was demonstrated before the Philadelphia County Medical Society about a month ago at which time I was able to show the healing process in the vertebra and the free movement of the spine in all directions Up until the middle of December this patient has received in all five courses of treatment each course representing or requiring from 27 to 30 doses making a total of 75 doses during a period of less than nine months She is asked to return at the end of three months for inspection and observation (Patient has returned April 1919 and is still free from symptoms and is doing all of her housework) She returned for examination exactly one year (March 17 1919) after she had been sent on a stretcher At this time she was free from all symptoms and the diseased vertebrae seemed to be healed (Fig. 1 and 2) She has been doing all her housework including the washing and ironing

I treated this patient probably more extensively than the others for I covered the entire spine and the entire body not including the extremities I have not included the

extremities in the treatment of these cases recorded for I fear that there would be too much destructive effect upon the blood. This may be a mistake on my part and we may find later that it is advisable to cover the entire body from the head to the extremities for surely there has been no serious effect upon the blood in the cases that I have just reported. There has been nothing to suggest destructiveness to the blood. In these cases the patients only had a few blood examinations made but there was nothing appearing in the blood except a moderate grade of anemia. If there were much destructive effect upon the blood the general health of these patients could not possibly improve as they have done.

#### TECHNIQUE

In the treatment of these cases one must not only keep in mind the localized disease discoverable by the X rays or by roentgenograms but we must treat the case as one of a general carcinomatosis and I think the next patient that I shall treat I will include the extremities and try to make the treatment a general one. In the four cases just treated however, the exposures were confined to the body not including the extremities and the whole body was divided up into about thirty areas crossing chiefly upon the spine but of course reaching all other parts of the body as well. I used for each exposure or for each dose 8 minutes with 5 milli amperes a 9 inch parallel spark gap 5 millimeters of current at a distance of 8 inches and the rays were filtered through 6 millimeters of glass or aluminum.

#### CONCLUSIONS

As a result of the studies made in these four cases and the treatment given I believe that the following conclusions are justified

- 1 The roentgen rays when applied properly and in sufficient quantity upon deep seated cancer tissue may be expected to destroy the cancer cell and this cancer cell is replaced by healthy scar tissue or fibrous tissue. When the disease is located in the soft tissues it is replaced by fibrous tissues and when located in bone it heals by bone sclerosis.

- 2 As a result of this healing process the patient is given the prolongation of life and is made more comfortable.

- 3 One cannot expect the patient to make a complete permanent recovery for ultimately the disease is apt to show metastasis particularly in the areas not treated.

- 4 It is entirely likely that these metastatic carcinomata of the spine without other evidence of metastatic involvement have an unusual amount of natural resistance and that this increased resistance on the part of the patient helps us greatly in the healing process. It seems to me likely that many of the patients or most of the patients die of visceral involvement before there is time enough for symptomatic disease to develop in the spine and so it is only in the more resistant cases that there is time enough for spinal metastasis.

- 5 With the clinical and microscopic proof of the destructive action on malignant tissue followed by a healing process and with the experimental proof of a decrease in the malignancy of cancer tissue which has been exposed to the X rays and a decrease in its capability of inoculation we can recommend most strongly the use of deep roentgentherapy both as ante operative treatment to be followed immediately by operation and then postoperative treatment given after the proper interval which should be four weeks after the ante operative treatment.

## THE TREATMENT OF UTERINE CANCER BY RADIUM

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 Assistant Professor of Obstetrics and Gynecology, Department of Medicine, Illinois Hospital

**D**URING recent years an increasingly conservative attitude in the treatment of cancer of the cervix uteri has been adopted in many of the large clinics. Cancer of the cervix uteri as regards its amenability to surgical treatment contrasts strongly with cancer of the fundus. The latter can be successfully removed in a large percentage of cases without exposing an otherwise normal individual to a serious risk, while the mortality after an adequately planned operation for cancer of the cervix is high and the percentage of cures disappointingly low.

During the last five years of the past century, the low percentage of cures produced by vaginal hysterectomy was generally recognized and the extended abdominal operation adopted by the more important operators. Wertheim has earned the credit of perfecting the details of this operation, having published his description in 1898. His operation represents the widest removal of carcinoma of the cervix. In experienced hands it has given a generally considered high percentage of cures based on a freedom from recurrence of 5 to 5 years.

The percentage of cures in any series of cases is however dependent upon the favorable character of the cases selected for the operation and the radical nature of the operation to which the patient is exposed. Thus we find that the most favorable statistics of cures accompanies as a general rule a low percentage of operability and a high primary mortality. In 1911 Jacobson collected statistics on the operability, primary mortality and curability as judged by the five year standard in 765 cases of uterine cancer reported by 130 operators.

Twenty eight operators recorded percentages of operability. These varied from 5 per cent to 90 per cent, seven less than 25 per cent, ten between 25 and 50 per cent, six over 75 per cent.

With some exception a definite relation

was found to exist between the percentage of operability and the mortality rate.

The primary mortality of the 2765 operations was 19.45 per cent. The mortality of many operators was below this, in the case of Jacobs 6.37 per cent, Zweifel 10.8 per cent, Kline 1.8 per cent, Wertheim 10 per cent (last two hundred cases), Doederlein 14.3 per cent.

Many of the operators could not report final results and with single exceptions there is no distinction between cancer of the fundus and cancer of the cervix. The following are the end results reported.

Bergesio and Berrutti of 60 patients operated on, 33 per cent were well one to four years afterward.

Bumm of 56 patients, 30 per cent were well one year and over.

Dobbert of 11 patients, 35 per cent were well one to four years afterward.

Doederlein of 15 cancers of the fundus, 72.7 per cent were cured according to Winter's standard and of 3 cancers of the cervix, 26.9 per cent were cured (same standard).

Mackenrodt of 144 patients, 61.5 per cent or 74 per cent of the survivors from operation were well one and a half to six and a half years afterward.

Olosson of 3 patients, 60 per cent were well five years later.

Peinecke of 27 patients with cancer of the cervix, 0 survived the operation and 7 or 35 per cent were well five years later.

In a subsequent report appearing in 1916 Jacobson includes more recent statistics and more definite information upon the permanent results of the radical abdominal operation for cancer of the cervix.

In the accompanying table I have combined these results with those of additional operators, some of which are still more recent.

A number of these authors have given statistics on the results of operation for cancer of the cervix by the vaginal route. Table II.

TABLE I—PERMANENT RESULTS OF RADICAL ABDOMINAL OPERATION FOR CANCER

| N m f Ope t                        | N mbe C es | Operab lity p e | Ope t   | M rality   | N mbe T l C 3 5 1 ar | C               |
|------------------------------------|------------|-----------------|---------|------------|----------------------|-----------------|
| B mm                               |            | 6               | 6       | ( 0% )     | 48 (5 yrs)           | 4 (5 yrs)       |
| H fm                               |            | 9               | 9       | 3 ( 0% )   | 3 (5 yrs)            | 3 (5 yrs)       |
| B                                  | 75         | 78 95           | 5       | 5 ( 5% )   | 50 (5 yrs)           | 0 (5 yrs)       |
| B y (Doed t Cl )                   |            | 56              | 8       | 4 ( 3% )   | 94 (5 yrs)           | 34 (5 yrs)      |
| B e                                |            |                 | 36      | 9 ( 3 3% ) | 3 (5 yrs)            | 8 (5 yrs)       |
| T yl                               | 4          | 68 7            | 8       | 1 ( 0% )   | 4 (3 5 yrs)          |                 |
| T g                                |            |                 | 1 (m d) | 8 ( 0% )   |                      |                 |
| C llect d f m geons West f th M pp |            |                 | 37      | 9          | 1 d g h w ases       | 5 (5 3 )        |
| C llect d from M Cl                |            |                 |         |            | (5 yrs)              | 5 (5 y )        |
| S h t l d d k rm                   | 677        | ( 56 3 8 )      | 56      | 46 ( 80% ) | (5 yrs)              | 4 (5 y )        |
| F (R th Cl )                       |            |                 |         |            | (5 yrs)              | 4 (3 yrs)       |
| C ll (J h H pk s Hosp t l)         |            |                 | 42      | ( 3% )     | 4 ( 5 y )            | 6 (8 4 yrs)     |
| Neel                               | 6          | 57 7            | 10      | 5 ( 5% )   | 6 (5 yrs)            | 3 ( 0m -6y )    |
| (Dr K lly Cl n)                    |            |                 |         |            | 6 (13 5 yrs)         | 4 (3 5 yrs)     |
| Cl k                               |            |                 | 36      | 3 (8 35% ) | 3 (3 5 yrs)          | 8 ( 6m 5 yrs)   |
| W bel                              | 1          | 7 8             | 675     | 1 ( 6 0% ) | 1 ( 1 75 )           | 7 ( 6 0m 5 yrs) |
| (W rth m Cl )                      |            |                 |         |            |                      |                 |
| Samps                              |            |                 | 8       |            |                      | 4 (5 0m 5 yrs)  |
| K r k                              | 236        | 8 4             | 09      | 4 ( 3% )   | 53                   | 5 ( 7 0m 3 yrs) |
| C bb                               |            |                 | 34      | 5 ( 4 3% ) | 6                    | 5 (8 0m 5 yrs)  |
| W g l                              | 3          | 6 8             | 37      | 3 ( 7 0% ) | 37                   | 7 ( 8 0m 5 yrs) |
| P och w k                          | 16         | 6 5             | 79      | 4 ( 7 0% ) | 3                    | 6 ( 4 0m 5 yrs) |
| P t                                |            | 1               | 1       | 5 ( 5% )   | 4                    | 8 ( 1 0% )      |

TABLE II—RESULTS OF OPERATION BY VAGINAL ROUTE

| N m f Ope t | N mbe C | Op p b lity t | Op rat | M rality                                  | N mbe C se Tm d 3 5 1 | C                         |
|-------------|---------|---------------|--------|---|-----------------------|---------------------------|
| S h t       | 3 5     | 38            | 6      | 30 (9 5% )<br>305 est t l m r lity 7 6 0% | 15                    | 5 Y Res lit 33 ( 7 4 0% ) |
| H fm        | ( 0 9 ) | 7 5 5         | 57     | 3 (5 6% )                                 | 5                     | 8 (37 8% )                |
| W g l       |         |               | 8      | 3 ( 6 66% )                               | 8                     | 3 ( 6 66% )               |
| P och w n k |         |               | 00     | ( 7 0% )                                  | 78                    | 6 ( 1 0% )                |
| W l         |         |               | 5      |   |                       |                           |

TABLE III—COMPARISON WITH RESULTS OF OPERATION ON FUNDUS

| N m f Ope t        | N mb C | Op p b lity t | Ope t | M rality | T N mb ed C | C es         |
|--------------------|--------|---------------|-------|----------|-------------|--------------|
| M y                |        |               | 6     | ( 7 6% ) | 4           | 5 (5 3 )     |
| T uss g f m M y Cl |        | 6 7           | 5     | ( )      |             | 54 (5 yrs)   |
| Cl k               |        |               | 3     | (7 7% )  | 3           | 7 (53 0% )   |
| W bel W th m Cl    |        | 69 97         | 67    | 7 ( 5% ) |             | 41 ( 0 3 )   |
| W g l              | 7      | 36 47         | 3     | ( 3 0% ) |             | 37 ( 0 5 y ) |
| P ocl k            |        |               | 60    | 7 0%     |             | 5 (34 46% )  |
| P t re             |        | 8             |       |          |             | 3 (5 0% )    |

For comparison with the results of operation on carcinoma of the fundus of the uterus Table III has been prepared

A summary of the e tables gives the following figures

Carcinoma of the cervix removed by the radical abdominal operation Of 50 / cases

14 5 or 34 1 per cent were operable Of 1097 cases there was a mortality of 364 or 18 23 per cent Of 1090 cases there were 386 cures (with few exceptions 5 years standing) or 35 41 per cent of traced cases or 19 32 per cent of cases operated on or less than 11 7 per cent of cases applying for treatment

Carcinoma of the cervix removed by the vaginal method. Of 1305 cases 654 or 58.1 per cent were operable (Schauta). Of 727 cases there was a mortality of 68 or 9.35 per cent. Of 647 cases there were 192 cures (5 years standing) or 29.67 per cent of traced cases or 17.74 per cent of cases operated on or less than 11.72 per cent of cases applying for treatment.

Carcinoma of the fundus of the uterus. Operability 76.47 or 97 per cent average 86.73 per cent mortality 20 of 244 cases average 8.19 per cent cures (5 years standing) 148 of 242 operations average 61.15 per cent or 53.03 per cent of cases applying for treatment.

If we accept Wertheim's conclusions that carcinoma of the cervix is twenty times as frequent as carcinoma of the fundus it is possible to calculate on this basis the combined percentages for operability, mortality and curability of cancer of the uterus, including both cancer of the fundus and cancer of the cervix by multiplying the percentages for carcinoma of the cervix by twenty, adding to the product the percentages for carcinoma of the fundus and dividing by twenty one.

Using this method the operability of carcinoma of the uterus is 37.61 per cent, the mortality is 17.74 per cent, the curability based on the five year standard for traced cases is 36.65 per cent for cases operated on 13.1 per cent for patients applying for treatment 9.82 per cent.

A review of these tables indicates at first glance that the operative statistics more certainly in the case of cancer of the fundus but even for cancer of the cervix are not unfavorable to this method of treatment. When however certain facts are considered in connection with these figures the operative treatment of cancer of the cervix is far from satisfactory.

In the first place while the immediate mortality in the most skillful hands is only 10 per cent it is still 20 per cent in skilled hands and in the hands of even Wertheim during the period of the development of his operation in his first one hundred cases it was 30 per cent.

Such a high mortality restricts the usefulness of the operation to relatively few surgeons entirely inadequate to meet the demands of the large number of patients having cervical cancer. Nor does this high mortality tell the whole story. It leaves out of consideration entirely first the necessity for restricting the operation to a small percentage of the most favorable cases and second the suffering entailed by the operation itself and its sequelae. Such sequelae followed von Rosthorn's operations in no less than 4 per cent and included ureteral and bladder fistulae, secondary necrosis of the bladder, injury to the rectum, fistulae of the intestine and in one case a division of the obturator nerve with permanent paralysis of the leg. Wabbel reports 6 per cent of ureterovaginal fistulae from the Wertheim Clinic.

Postoperative sequelae including suppuration of the abdominal incision, cystitis, peritonitis, ureteral fistulae, vesical fistulae, phlebitis, laceration of the rectum, pleurisy and rectovaginal fistulae occurred in cases of Clark's 36 patients or in 73 per cent.

The majority of these postoperative sequelae are of course temporary but a sufficient number are permanent to constitute a real objection to the operative treatment of cancer of the cervix. These various unfavorable complications of the operation, the high mortality after an operation which is at all adequate, the by no means infrequent and unpleasant postoperative sequelae and finally after a woman has faced all these risks not to mention the discomfort of the operation itself, the rather small prospect that she will be permanently cured, that she will not be obliged to suffer a lingering and painful death has caused many of the most prominent gynecologists to adopt a more conservative attitude toward the radical abdominal operation for cancer of the cervix.

This attitude is expressed in the concluding sentence of Schottlander and Kramaurer's book. The time is not yet ripe for a review and criticism of the literature, many co-workers are yet necessary. At present we can only say that we do not wish to underestimate or overestimate the importance of the abdominal operation. We are still at the

beginning of its development At the time he wrote be considered it to be the only way to meet demands of the carcinomatous process

Clark voices the same dissatisfaction with the operative treatment of cancer of the cervix He states If an operation or other therapeutic procedure is to have a permanent place in our armamentarium it must be sufficiently easy to make it available not for a few skilled specialists but for the great body of surgeons working in every quarter of this and other countries In these days of low mortality percentages attending nearly all the major operations no operation can possibly gain beadway which combines with it a shockingly high mortality and a large number of distressing and disabling sequelæ

Further while the continental surgeon with his large and overcrowded clinics may ignore the question of mortality in working out a principle the American surgeon as well as the American layman is so temperamentally constituted that the one cannot and the other will not disregard a high primary death rate The effect upon the lay mind therefore must be taken into consideration for while one may have over 50 per cent ultimate cures the effect upon the average intelligent citizen is abhorrent if for this number of survivors there have been twenty five deaths and for the other twenty five a wretched existence attended by repulsive postoperative sequelæ followed by a painful and lingering death It is possible that when we make a final summary of our combined experience we may have to accept the conclusion that a less radical operation even though it save fewer cases may be preferable when attended by a low surgical mortality and few or no operative sequelæ

Peterson I believe sounds the same note He states Unfortunately added experience has strengthened my belief that the extended operation for cancer of the cervix is an exceedingly dangerous operation always attended by a high primary mortality No one will be more glad to discard the radical abdominal method than will I if I can be shown that more patients can be ultimately saved by less dangerous methods

Since the above quoted expressions about the radical abdominal operation were written another method of treatment of cancer of the uterus its treatment by radium has become prominent

Wickham can be properly referred to as the father of the radium treatment of cancer He began his work in 1906 and published the results of the treatment of a thousand cases of cancer in 1910 and 1913 Also as a pioneer and working with Wickham must be mentioned Dominici who is responsible for the development of many technical improvements particularly in the principles of filtration Following these men many isolated reports have appeared especially may be mentioned those by Caan in 1909 and Czerny and Caan in 1912 and Pinch in 1912 by Riehl Ranz Schueller and Sparmann in 1913 in this country Abbe and finally the book by Paul Lazarus in 1913 It is just to give to Kroenig the credit of the most important introduction of the use of radioactivity in gynecology but while he may have done the pioneer work in gynecology it was Doederlein's and Bumm's reports before the *Deutsche Gesellschaft fuer Gynaekologie* at Halle in May 1913 and the papers by Cheron and Rubens Duval Schauta Schindler Scherer and Keley and Latzko and Schueller all in 1913 that furnished the great impetus to the treatment of cancer of the uterus by radium

Doederlein reported one cure of an operable case of cancer of the cervix and excellent results in other cases He presented microscopic sections proving the retrogression of cancer after the use of radium

Bumm reported nine cases of apparent clinical cure of patients with advanced cancer of the cervix by the use of mesothorium and X rays

Cheron and Rubens Duval reported 155 results conservatively classified as improvements of 158 patients with advanced cancer of the cervix Forty six of these improvements are probable cures In two of the cases both inoperable the cure was proved in one by autopsy and in the other by histological section

Schauta reported 11 clinical cures out of

16 patients with cancer of the cervix treated by radium and mesothorium. He believed that radium was the more effective of the two agents.

Schindler described some very favorable results in the treatment of cancer of the cervix by mesothorium and radium.

Scherer and Keley concluded that the treatment of 218 cases of cancer of the cervix by X-ray and radium gave 15 per cent greater freedom from recurrence than operation alone formerly gave.

Latzko and Schueller reported 5 clinical cures of 7 advanced cases of cancer of the uterus.

In the succeeding year still more encouraging results were published.

Bumm then recorded 105 cases of carcinoma of the cervix treated by radium. Of these only 5 were operable growths. Among them there were only 15 recurrences to date and a clinical cure had been produced in 10 in operable growths.

Doederlein and von Siefert obtained a disappearance of all subjective and objective symptoms in 31 of 153 cases of cancer of the uterus and 12 of the 31 were inoperable.

Kroenig recorded 54 cases of cancer of the uterus treated by X-ray and mesothorium. Sixty-four were treated prophylactically after operation and 150 entirely without operation. Nineteen have undoubtedly remained free from cancer. He concluded that in cases in which cancer was still localized to its primary site the type of case usually termed operable he was able to cause the complete disappearance of the cancer as far as could be recognized histologically. His longest cure however had been under observation for only two years. He had never been able to cure metastatic carcinoma nor in those cases in which the disease had invaded the neighboring tissues deep invasion for instance of the broad ligaments though remarkable retrogressions and temporary cessation of growth had followed the treatment of the latter.

Nobbert made in many respects the most important contribution in 1914. The results of the treatment of 44 cases of cancer of the uterus of which 31 were cancers of the cervix

18 inoperable and 6 operable were so good that they justify him in concluding that it is permissible to treat early operable cancer of the cervix by radium alone. In many cases when the invasion of the tissues around the site of origin was deep an elimination of the growth might be expected. In still more advanced cases a condition temporarily approaching a cure could be obtained. In the very advanced cases he discouraged treatment.

Weinbrenner described eight most successful results in the treatment of 3 cases of cervical carcinoma by mesothorium.

Allman reported results on 85 patients with cancer of the uterus treated with mesothorium. At the time of his report 15 of these patients were free from symptoms. These 15 patients either had recurrent growths or had refused operation. Twenty other inoperable cases became operable.

Legneu and Cheron reported a patient with an extensive entirely inoperable cancer of the vagina treated with radium and two and a half years after the completion of the period of treatment the patient died after an operation for another trouble. An autopsy was obtained and the complete absence of cancer demonstrated. Other confirmatory reports but of less definite character have appeared from Morton, Dieffenbrich, Foveau de Courmelles, Jacobs, Kroemer, Tate, Pozzi and Rouhier, Oertel, Seuffert and Klein.

In 1915 far more definite results were reported many of which give information on the permanency of treatment by radium.

Doederlein now reports 12 patients with inoperable uterine cancer treated by radium and well at the time of his report more than a year from the time the treatment was given. He definitely advocates the use of radiotherapy for operable uterine cancer.

Flatau states that since December 1913 a period of one and a half years he has not operated upon a single case of cancer of the cervix and has obtained a larger number of cures for an equal number of cases than be ever obtained by operation though his mortality after operation was only 1 per cent.

Burrows reports that a disappearance of early cancer of the cervix and marked im-

provement in the more advanced lesions after treatment by radium is fairly constant.

Degrais reports a number of patients who had advanced cancer of the cervix treated by radium who are in good health at the time of the report four years after treatment.

Kelly and Burnum have made the most extensive use of radium in this country and have done so under very favorable conditions. They report the results on the treatment of 213 patients, 14 of whom were operable. Of these operable cases 4 were treated with radium alone and are all well 2 for a period of two years and 2 for a period of one year after the treatment. The remaining 10 of the operable group were operated on first and afterward treated with radium. All were well at the time of the report at intervals of six months to three years after the treatment. The authors consider that these results are suggestive when it is considered that after operation alone there is a recurrence in 75 per cent and in 60 per cent of the cases in the first year. One hundred and ninety nine patients treated were inoperable at the time of the treatment; these included inoperable primary growths and inoperable recurrent cases. Fifty three of this group are clinically cured and 109 markedly improved. Of 35 patients of this group all primarily inoperable 3 have remained well for four years, for three years and 17 for over one year. Eighteen primarily inoperable recurrent growths of this group are now clinically cured, 1 patient over six years, another over four years, 11 over two years and 10 over one year.

In other words 57 of 133 patients with cancer of the cervix, 4 operable and 53 inoperable have been cured by radium; that is all of the operable cases and 6 per cent of cases considered inoperable at the time of their treatment.

Brush reported that he has treated all cases of cancer of the uterus and vagina with mesothorium since February, 1914. At the time of his report he had treated 200 cases. The duration after treatment is from about twenty one weeks to six months. He divides his patients into three groups. One group, 43 patients were all inoperable with definite

parametrial infiltration. Many of these were benefited but only one clinically cured. In a second group of patients on the borderland of operability 10 or 50 per cent were clinically cured. The third group included 37 operable patients. Of these 8 or 75 per cent were clinically cured.

Adler reported a clinical cure in 9 inoperable cancers of the cervix, inoperable cancers of the body of the uterus and 1 of the vagina.

St. Clair recorded 2 cases in which radium was applied after incomplete operations for advanced cancer of the uterus. Fourteen months after the application in one case and a shorter interval in the other, both patients were as far as could be ascertained free from disease.

Fabre reported excellent results in 10 cases the detailed histories of which were given.

Sir Thomas Oliver reported a very extensive recurrent cancer of the vagina apparently cured by a single application.

Von Graff, using the dosage recommended by Wertheim and waiting two years after a rather discouraging article by Wertheim on the radium treatment of uterine carcinoma, reported most encouraging results from the treatment of 102 cases of cancer of the uterus by radium. He concluded that radium therapy gives better results in the management of inoperable cases than any other method of treatment and not a few cases thought inoperable have been so improved that the presence of carcinoma could no longer be demonstrated.

Miller also reported enthusiastically on the action of radium in advanced uterine cancer. He reported 6 cases, only one of which had gone one year from treatment. This patient presented two years after operation an extensive recurrence in the vault of the vagina. At the time of his report one year after her treatment by radium she was entirely free from symptoms.

Fueth and Ebeler reported results from the treatment of 56 patients with uterine cancer. Ten of these patients were operable and in each case retrogression had become complete or nearly so at the time of the report. Eleven other patients were treated prophylactically and six of the remaining number all



inoperable were clinically cured. Other papers appearing in 1915 supporting the same conclusions are by Bergonie and Speder Abbe Kolischer Turner and Ransoboff.

Schmitz in a paper appearing in 1916 recorded his results in the treatment of 60 cases of pelvic cancer. Of these he has obtained a clinical cure in 11 of 35 cases of inoperable cancer of the uterus in 7 of 1 operable patients and in 4 of 15 recurrent cases making a total of 2 clinical cures of 6 patients or 35.5 per cent. The post treatment interval varied from four to twenty four months. This report is very significant when we consider that 50 of his 62 patients or 80 per cent were not operable.

In the past year several important papers have appeared which more than confirm previous reports.

Maiolo has treated 40 patients all of whom were inoperable or recurrent after hysterectomy. Eight of these patients were recently treated but of the remaining 42 16 are anatomically and clinically cured for periods of one to two years.

Esquerido has treated 12 cases of uterine cancer of the 3 were operable and all completely retrogressed. Of the remaining 7 inoperable patients 3 were apparently cured.

Bailey reported 16 patients apparently free from disease of 120 patients with uterine cancer treated with radium. Of these the post treatment period had been two years in 1 case and one and a half years to two years in 4 cases 14 months to one year in 8 cases and one to six months in 3 cases.

Myers reported three excellent results though recent in 3 patients out of 5 whom he had treated. Labhardt Klatz and Heilmann also reported favorable results.

Two other papers of particular importance have appeared during the past year.

The first of these is by Pecassens of Madrid. Pecassens at first used radium only upon those cases which were too advanced for operation or in which operation was contra indicated but his uniform success makes him no longer hesitate to treat early cancer of the cervix with radium. He states that if in inoperable cancer in which an actual extension to the parametrium exists so that the possibility

of a cure by operation can no longer be entertained one can obtain a cure by radium in 60 per cent of the cases. It is only logical to believe that in early circumscribed cancer of the cervix a cure by radium is more certain. He contrasts the gravity of the Wertheim operation with its primary mortality of 10 to 15 per cent in the hands of the best surgeons and its secondary mortality after the lapse of three to five years of 40 to 50 per cent with the comparatively safe and simple procedure of treatment by radium with its 100 per cent of cures in this stage. His belief that 100 per cent of the early cases are cured by radium is based on the fact that every one of 16 such cases which he has treated has undergone a complete retrogression and a number of these have already completed three years since the treatment was applied.

In addition to these results in operable cancer he has treated 182 inoperable cancers of the cervix. Forty seven of these were treated in the year 1914 and of these 29 were well at the time of the report. In 1915 he treated 79 patients of which number 45 were well at the time of the report. He has not been so fortunate in cancer of the body of the uterus. Of 16 cases of cancer of the body only 8 were clinically cured and 6 have died 2 being still under treatment. He concludes that 10 per cent of his inoperable cancers and 95 per cent of those cases in which the growth was still limited to its site of origin have been cured by radium. Fifty per cent of his cases of cancer of the fundus have been cured but in this group he prefers operation unless the woman is fat or possesses some other contra indication to operation.

A second paper of equal importance is by Clark. He reports 100 patients with genital carcinoma treated by radium. Seventy four of these were carcinoma of the cervix and 4 of the fundus. Fifty five of these patients were alive and free from symptoms two to thirty months after treatment and in the case of 5 patients twenty two to thirty months after treatment.

My own cases are few in number being limited to patients referred to me for personal care. The majority of them are from the

standpoint of operability border line cases. They are in consequence important from the standpoint of radiumtherapy and I wish to put them on record first because I believe that the results obtained in them illustrate what can be obtained by the use of radium, in place of operation in early cancer of the cervix a preference in treatment which is shared at present by very few surgeons second, because I believe that there is an advantage in using the method of treatment which has been employed in these cases and which has been the outgrowth of my use of radium in other portions of the body

#### CARCINOMA OF THE CERVIX—17 CASES 12 CLINICALLY CURED TO DATE $3\frac{1}{4}$ YEARS TO 6 MONTHS AFTER TREATMENT

CASE 1 Operable carcinoma of the cervix clinically cured to date  $3\frac{1}{4}$  years after treatment M F Hosp No 23027 age 48 On admission on March 25 1916 the cervix was found to be enlarged and its vaginal surface ulcerated. The ulceration surrounded the external os but did not reach the vaginal walls. The margins and base of the ulcer were raised hard and nodular. The body of the uterus was not enlarged. Microscopical examination revealed plexiform epidermoid cervical carcinoma. The cells showed slight swelling much nuclear hyperchromatism and homogenization of the nuclei. At some points there was a rich exudation of lymphocytes and polymorphonuclear leucocytes which encroached on the masses of degenerating tumor cells. The patient's attention was first attracted to her disease by intermenstrual bleeding and rather profuse menstruation during the past two months.

*Treatment* On March 25 1916 1 tube containing 60 millicuries in 1.5 millimeter rubber covered platinum was left in the cervical canal for 16 hours 2 tubes containing 200 millicuries in 1.5 millimeter rubber covered platinum were left on vaginal surface of cervix for 16 hours. Examination on January 10 1917 revealed no evidence of disease present. Examination May 6 1918 showed absence of any evidence of disease. As the patient lived a long distance from New York it was decided to give a prophylactic and mild treatment. One tube containing 39.8 millicuries in 1 millimeter rubber covered platinum was placed in the vault of the vagina 6 hours.

Examination May 1919 failed to discover any evidence of disease and a letter July 15 1919 stated that the patient was in perfect health.

CASE 2 Carcinoma of cervix uteri on the border land of operability clinically cured to date 3 years after treatment J H Hosp No 235 1 age 52.

On admission July 31 1916 the cervix was found to be considerably enlarged and very hard. The

body of the uterus did not feel enlarged. Extending over the dorsal portion of the cervix about halfway to the reflection of the mucous membrane to the vaginal wall was an ulceration with hard base. Microscopical examination revealed plexiform epidermoid carcinoma. The patient has never considered herself strong and has been very nervous since an attack of nervous prostration 18 years ago. She has had three children and one miscarriage 9 years ago. The oldest child is 7 youngest 16. The births were normal. Her menses have always been regular every  $3\frac{1}{2}$  weeks of 5 to 6 days duration with profuse flow. From April 15 1916 to June 30 there was no menstruation. Then she was in bed with an intermittent flow for two weeks. After being up one week she started to flow again and has had intermittent moderate flow ever since.

*Treatment* On July 3 1916 3 tubes containing together 300 millicuries in 1 millimeter rubber covered platinum were placed one in the cervical canal two against the vaginal surface of the cervix for 12 hours. On September 20 1916 the ulceration on the outside of the cervix was almost healed. The cervix was diminished in size and the uterus freely movable. One week following treatment the patient had a hemorrhage similar to the previous ones the bleeding lasting one day. There was a gradual diminution of the discharge and there has been no discharge of blood since. At no time have there been any bladder or rectal symptoms. Her general health is steadily improving. Examined June 6 1918 and found free from evidence of disease. Letter June 18 1919 states that the patient is in perfect health.

CASE 3 Operable carcinoma of the cervix clinically cured to date 1½ years after one application of radium. M F Hosp No 24748 age 4. The patient has had good health. Ten years ago she was operated upon for tubal pregnancy. Eleven years ago she was curetted for a miscarriage. She has been married 25 years. She is the mother of one child by instrumental delivery. The patient applied for treatment September 5 1917. Six months before this the menses became irregular. Three months ago there was profuse bleeding at frequent intervals. Examination shows the posterior lip of the cervix to be the seat of an ulcer 2 by 3 centimeters. The whole cervix is enlarged and hard. The uterus is movable and normal in size. There is no infiltration in the broad ligaments. Microscopical examination reveals epidermoid carcinoma.

*Treatment* On September 5 1917 3 tubes containing 123 millicuries in 0.5 millimeter silver were arranged end to end in the uterocervical canal and left for 8 hours also 3 tubes containing 60 millicuries in 0.5 millimeter silver were applied against the cervix in dental modeling compound for 8 hours. Healing followed in two months and the patient has been free from evidence of disease since.

Examined November 1918 and found free from

evidence of disease. Letter dated July 18 1919 states that her health is perfect.

**CASE 4** Operable carcinoma of the cervix clinically cured to date 1 1/2 years after one treatment by radium. B R H Hosp No 25129 age 74. The patient has had good health aside from sciatica and tonsillitis. The menses appeared at the age of 11 were scanty and regular lasting from 5 to 6 days. Last date of menstruation at 54. She has had three children between 56 and 34 years ago. Labors were rather difficult with slight tears. The patient applied for treatment January 16 1918 four years before this she developed a partial prolapse of the uterus. Two weeks ago she sought treatment for the prolapse and was advised to wear a pessary. This was inserted and at the time of insertion a small ulcer was found on the cervix. She had felt no pain nor noticed any discharge from this. Examination showed a small ulcer on the anterior lip of the cervix about 2 centimeters from the external os. The ulcer measured 2 by 1.25 centimeters and was 0.5 centimeter deep. No deep infiltration was present. Microscopical examination revealed epithelioma of the cervix.

**Treatment** On January 6 1918 2 unfiltered minute glass tubes containing 8 millicuries were embedded in the base of the ulcer their period of decay giving an exposure of 1056 millicurie hours. On June 30 1918 there was no evidence of the disease and no induration. On February 2 1919 the patient was examined and found free from evidence of disease. Letter dated July 20 1919 states that she is free from uterine symptoms.

**CASE 5** Inoperable carcinoma of cervix clinically cured to date 14 months after the first application of radium. C S Hosp No 543 age 34. The patient has enjoyed very good health and has never been ill until the present trouble. The menses have been regular and normal. She has two children 13 and 4 years of age. The births were difficult and no instruments were used. The patient applied for treatment May 1 1918. Three or 4 months before she first noticed bleeding from the vagina. This gradually increased up to the present time. Her physician at first advised operation but after having her under observation for about four weeks referred her to us for treatment. Examination showed the anterior lip of the cervix completely replaced by a large fungating papillary mass 5 centimeters in diameter completely filling the vault of the vagina. It bled on slightest touch and involved the mucous membrane as far as the vaginal wall. The uterus was movable. Microscopical examination revealed papillary pleomorphic epithelioma.

**Treatment** On May 1 1918 3 tubes containing together 191 millicuries in 1 millimeter platinum were applied for 15 hours the tubes being arranged end to end in a rubber tube placed in the uterocervical canal. On the same day 7 unfiltered minute glass tubes containing together 91 millicuries were embedded in the tumor mass their

period of decay giving an exposure of 21 millicurie hours. Following the treatment there was a quick retrogression of the tumor mass and retrogression appeared to be complete on August 19 1918. Examination June 1 1919 no evidence of disease. Letter July 20 1919 patient in perfect health.

**CASE 6** Borderland but probably operable carcinoma of the cervix clinically cured to date 14 months after one application of radium. N H D Hosp No 25459 age 53. The patient has previously had good health. She has two children the first an instrumental difficult delivery. The menses have always been regular and normal. She applied for treatment May 10 1918. In March 1917 she noticed an intermenstrual flow which gradually grew worse. She was curetted in April 1918. Examination showed the vaginal surface of the cervix to be normal. The uterus was movable though together with the cervix was enlarged one third the normal size. Microscopical examination revealed basal cell carcinoma beginning within the cervical canal.

**Treatment** On May 11 1918 5 unfiltered minute glass tubes containing together 21 millicuries were embedded in the tissue of the cervix the decay period of which gives a dosage of 295 millicurie hours. All 3 tubes 156 millicuries in 1 millimeter platinum were applied for 9 hours the tubes being arranged end to end in the uterocervical canal. Examination September 30 1918 showed no evidence of the disease. Examination June 4 1919 showed no evidence of disease and letter dated July 20 1919 states the patient's health is perfect.

**CASE 7** Inoperable carcinoma of the cervix clinically cured to date 13 months after one treatment by radium. S L Hosp No 5563 age 44. The patient had scarlet fever when a child. She has had three children and one miscarriage. The first child was born 5 years ago a normal difficult labor. The second child was born 1 year later and the third ten years after that. The menses have been regular and normal and there has been no unnatural discharge. The patient's general health has always been good. She applied for treatment June 15 1918. Ten months ago menstruation did not occur at the regular time but a profuse and irregular bleeding from the vagina appeared. There was no pain no constipation and no bladder trouble. Examination showed the posterior lip of the cervix enlarged to twice the normal size and covered its surface was a papillary growth infiltrating the underlying tissue. There was no infiltration of the broad ligaments. Microscopical examination revealed epithelioma of the cervix.

**Treatment** On June 15 1918 11 unfiltered minute glass tubes containing together 25 millicuries were embedded in the cervical mass the decay period giving a dosage of 669 millicurie hours. All 3 tubes containing 8 to either 37 millicuries in millimeter platinum were applied for 7 hours the tubes being arranged end to end in a rubber tube placed in the uterocervical canal.

March 1 1919 Absolutely free from all local or general evidence of disease There is no ulceration on the cervix The cervix and uterus are normal in size and freely movable Examined June 19 1919 and found free from any evidence of disease

CASE 8 Operable carcinoma of the cervix clinically cured to date 12 months after one application of radium M McC Hosp No 5657 age 40 The patient had scarlet fever followed by edema of the legs for a period when a child Otherwise her health has been good The menses have been regular and normal in amount She has no children The patient applied for treatment July 16 1918 Three months ago the patient noticed during an attack of constipation some bleeding in the interval between menses The flow increased and lasted from one to three days She felt no pain and no discharge between periods of hemorrhage Examination showed the surface of the cervix to be destroyed by a hard rigid nodular ulcer The ulcer extended posteriorly to the vaginal vault and bled easily The uterus was normal in size although its movement was somewhat restricted Definite induration in the broad ligaments could not be made out Microscopic examination revealed epidermoid carcinoma

Treatment On July 16 1918 16 unfiltered minute glass tubes containing together 0.2 millicuries were embedded in the tumor mass the period of decay giving a dosage of 3854 millicurie hours also 3 tubes containing together 100 millicuries in 1 millimeter platinum were applied for 20 hours the tubes being arranged end to end in a rubber tube placed in the uterocervical canal Examination May 29 1919 showed no evidence of disease Letter dated July 21 1919 states that patient's health is perfect

CASE 9 Inoperable carcinoma of the vagina clinically cured to date 11 months after one application of radium C S Hosp No 25686 age 40 The patient has had infrequent epileptic attacks for 20 years She had appendicitis last January The menses have been painful She has had four children labors difficult The patient applied for treatment July 25 1918 Two years before she began to have slight hemorrhage from the vagina and pain in the right groin She has had constant backache and frequent micturition Examination showed the vaginal wall immediately adjacent to the right side of the cervix covered with a neoplastic mass consisting of 2 nodules one centimeters in diameter and the other 1 centimeter in diameter Microscopic examination showed epithelioma

Treatment On July 27 1918 11 unfiltered minute glass tubes containing together 25 millicuries were embedded in the tumor mass the period of decay giving a dosage of 3300 millicurie hours also 3 tubes containing together 81 millicuries in 1 millimeter platinum were applied for 11 hours the tubes being arranged end to end in a rubber tube and placed in the uterocervical canal September 25 1918 the ulceration was entirely healed March 1 1919 retrogression still appears

to be complete July 10 1919 examined and found free from all evidence of disease

CASE 10 As regards operability a borderline carcinoma of the cervix previously cauterized clinically cured by an application of radium Later recurrence in the retrovaginal septum apparently successfully treated by a second application M S Hosp No 25039 age 46 The patient has always been in good health with no previous illness Her menses have been normal as to time and duration She has had two children 24 and 2 years of age The first birth was instrumental the second normal The patient applied for treatment October 22 1918 Four months ago she began to flow continuously and was examined in May 1918 Cauterization of the neck of the womb was suggested but was postponed until August when she was told that a cancer had formed Two weeks following cauterization hemorrhage appeared again and continued to the present time with pain in the groin Examination revealed the absence of the cervix and in the center of the remaining portion of the canal an ulcerated area which did not feel very hard The uterus was movable Microscopic examination showed recurrent carcinoma of the uterus

Treatment On October 23 1918 2 tubes containing together 117 millicuries in 1 millimeter platinum were applied for 21.5 hours the tubes being arranged end to end within a rubber tube placed in the uterocervical canal November 20 1918 two nodules have developed in the posterior vaginal wall November 20 1918 2 tubes containing together 5 millicuries without filtration were embedded within the nodules in the posterior vaginal septum December 26 1918 the nodules have been replaced by a broad indurated ridge and on this day 4 unfiltered minute glass tubes containing together 0.3 millicuries were embedded in the mass in the postvaginal septum giving a dosage of 1227 millicurie hours February 12 1919 the induration in the postvaginal wall has not disappeared and a small rectovaginal fistula has developed July 17 1919 the induration in the rectovaginal septum has disappeared and the fistula has closed and no evidence of disease remains

CASE 11 Inoperable carcinoma of the cervix clinically cured to date 9 months after one treatment by radium L F Hosp No 25058 age 40 The patient's previous health has been fair though she has never been robust The menses have been regular but inclined to be a little profuse lasting 6 to 7 days She has two children 16 and 3 years of age When the first child was born instruments were used and the patient sustained a severe laceration in the cervix uteri which was never repaired Digestion is sensitive and the bowels regular The patient applied for treatment October 30 1918 Last April she first noticed the pain in her back There was no change in the menses until June when menstruation became more profuse and appeared every two weeks In September there occurred three severe hemorrhages 24 hours apart Her

symptoms became gradually worse to date. Examination showed that the whole cervix was destroyed by an ulcerated infiltrating growth which was covered on its surface with slough and neoplastic nodules. The infiltration extended to the anterior and posterior vaginal walls and into the broad ligaments so that the normal mobility of the uterus was greatly reduced. Microscopical examination revealed epidermoid carcinoma.

**Treatment.** On October 30, 1918, 6 unfiltered minute glass tubes containing to ether 21 millicuries were embedded in the cervix; their period of decay giving a dosage of 2772 millicurie hours. Also 3 tubes containing 142 millicuries with 1 millimeter platinum were applied for 18 hours; the tubes being arranged in tandem fashion in the uterocervical canal. On November 6, 1918, 1 tube of 44 millicuries in 1 millimeter platinum was applied for 12 hours; the tube being placed within the cavity of the uterus. January 3, 1919, examination showed complete healing of the ulceration except for a small nodule the size of a pea to the right and behind the external os. The induration had disappeared to a large degree so that the cervix was not much harder than normal. The infiltration in the broad ligaments was still present though less and the movement of the uterus as still somewhat restricted. March 7, 1919, there was an entire disappearance of ulceration and induration. There was no evidence on examination that any malignant tissue remained though the cervix was deformed and its mobility limited as a result of its destruction by the new growth and the scarring following treatment.

**CASE 12.** Inoperable carcinoma of the vagina clinically cured to date 6 months after one application of radium. J. McC. Hosp. No. 6005, age 50. The patient had bladder trouble when 8 years of age; typhoid at 6 years. Menstruation had been normal. Eight years ago she began to have menorrhagia and metrorrhagia which persisted for a year until the patient took some local treatment which relieved her. On November 14, 1918, she applied for treatment. Five weeks ago she began to have pains throughout the lower abdomen radiating down the thigh. Menstruation became scanty and an irregular and watery leucorrhœa blood tinged and offensive developed. Examination showed the posterior right lateral and anterior vaginal walls to be covered with an ulcerated infiltrating mass covered by nodules which formed three rather well separated discrete masses. The total area of the mass was 6 by 9 centimeters. No glands were palpable in the groin. Microscopical examination showed epidermoid carcinoma of the vagina.

**Treatment.** On November 16, 1918, 8 unfiltered minute glass tubes containing together 23 millicuries were embedded in the tumor mass giving a dosage of 3036 millicurie hours. On December 24, 1918, the entire lesion had disappeared except for a small fibrotic nodule in the posterior wall of the vagina just behind the introitus.

May 1, 1919, free from evidence of disease.

**CASE 13.** Inoperable carcinoma of the vagina and cervix improved for 8 months by one treatment of radium subsequent applications ineffective. W. C. Hosp. No. 24452, age 56, had always had good health. The menses were regular and normal. She has had several children and three miscarriages. There were lacerations when the first child was born and ever since she has had a severe prolapse of the uterus. The patient applied for treatment May 23, 1917. About one year before this she began to feel pain in the left lower quadrant of the abdomen. It has increased in severity during the past four months and has been accompanied with a slight flow. Her general health has deteriorated. She has lost 30 pounds in the past year. Examination discloses an indurated ulcer covering an area of 6 square centimeters in the vault of the vagina and involving the cervix. Microscopical examination reveals papillary pleomorphic epidermoid carcinoma.

**Treatment.** On May 28, 1917, 4 tubes containing to ether 37 millicuries filtered through 5 millimeters silver applied for 1 hour against surface of ulcer in dental modeling compound. On October 1, 1917, there was no evidence of the disease. On March 19, 1918, a small recurrent ulcer was found in the vault of the vagina and 3 tubes containing to ether 14 millicuries without filtration were embedded in the ulcer.

Following this treatment local improvement was reported but the patient failed to return for observation until September 7, 1918, when an extension of the disease was observed. On October 1, 1918, 6 tubes containing together 20 millicuries without filtration were embedded in the ulcerated area.

On March 1, 1919, a urinary fistula developed around it, an ulcer 3 centimeters in diameter with indurated base and edges and considerable deep infiltration of the underlying tissue characteristic of neoplastic tissue.

The poor result in this case is attributed probably to the inaccuracy and small dose of the first application which in turn depended upon the extreme mobility of the uterus and looseness of the vaginal walls. A better result could have probably followed the embedding of emanation tubes in the ulcer.

**CASE 14.** Extensive carcinoma of the vagina temporarily improved by surface application of radium recurrence in 4 months and gradual deterioration of the patient's condition. E. C. Hosp. No. 24467, age 60 years. Except for a severe attack of pneumonia two years ago the patient's health has always been good. The menses were regular and normal. She has had nine children. The menopause occurred at the age of 40. The patient applied for treatment June 4, 1917. Two years before this she noticed a slight yellow discharge and since that time she has lost 10 pounds in weight and has gradually lost her strength and the discharge has increased in amount. Examination shows that the whole anterior wall of the vagina and adjacent portion of the cervix is the seat of an

indurated growth the surface of which is covered by small neoplastic nodules. Microscopical examination reveals carcinoma of the vagina.

**Treatment** On June 4 1917 4 tubes containing together 360 millicuries in 0.5 millimeter silver were applied over the surface of the ulcer in dental modeling compound for one hour. On July 17 1917 the lesion was found to be reduced to one half the original size. On the same day 6 tubes containing 108 millicuries in 1 millimeter platinum were applied over the surface of the ulcer in dental modeling compound for 4 hours. On August 17 1917 retrogression seemed to be complete. On October 4 1918 a fresh ulceration appeared on the anterior lip of the cervix and on October 7 1918 3 tubes containing together 256 millicuries in 1 millimeter platinum were applied for 1 1/4 hours in the uterocervical canal.

Following this treatment a uterovaginal or vesicovaginal fistula developed although continued retrogression of the disease took place. Her general health gradually deteriorated and the presence of internal metastases was feared. Report on March 11 1919 states that she has not had any bleeding in the last 4 weeks. The urinary fistula is still present and she is very weak but during the past 5 or 6 days she has been gaining in strength.

**CASE 15** Inoperable carcinoma of the cervix clinically healed for almost a year by one application of radium recurrence incompletely controlled by a second treatment. J. B. Hosp. No. 24605 age 44. The patient's previous health has been good. She has had two children one miscarriage induced by instruments at 3 months followed by infection which confined her to bed for months. The patient applied for treatment August 15 1917. Last November (1916) menstruation became profuse without pain. In March 1917 an intermenstrual bleeding developed and soon became nearly constant and continued to time of applying for treatment with perhaps a week's intermission now and then and still without pain. For the previous few weeks an offensive leucorrhoea has been present and the bleeding has become less profuse. She has lost much strength and some flesh. Examination shows that the whole of the vaginal surface of the cervix is destroyed by an ulcerated growth the surface of which is covered with numerous neoplastic papillary projections. The uterus itself is not much enlarged and its normal mobility does not appear to be restricted. Microscopical examination reveals carcinoma of the cervix.

**Treatment** On August 16 1917 tubes containing together 140 millicuries in 1 millimeter platinum were applied in a rubber covered tube in the cervical for 1 hour also 13 tubes containing together 325 millicuries filtered through 0.5 millimeter silver were applied in dental modeling compound against the cervix for 12 hours. On November 5 1917 there was found on the anterior lip of the cervix a hard dense nodule but no definite evidence of neoplastic tissue was present (ulceration

healed). December 17 1917 showed the cervix still healed. The patient complained of painful defecation. Examination revealed induration in the rectovaginal septum and some thickening of the broad ligaments. April 11 1918 examination showed that the thickening of the rectovaginal septum had increased producing stenosis of the rectum. On August 12 1918 8 unfiltered minute glass tubes containing together 16 millicuries were embedded in the mass in the rectovaginal septum giving a dosage of 11 millicurie hours. Following this treatment a rectovaginal fistula developed. To relieve this and the pain in the rectum due to the recurrence a colostomy was performed on September 5 1918. This afforded the patient much relief from pain but the infiltration of the tissues in the vault of the vagina remained and the patient's general condition steadily deteriorated.

June 1919. During the past few months a remarkable improvement in the whole condition of the patient has developed. She left her bed came to the office and was examined. Considerable diffuse induration still remained in the vault of the vagina but the patient's general condition aside from the presence of some pain and oedema of the legs was good.

**CASE 16** Inoperable carcinoma of the cervix clinically improved for 9 months after one application of radium. K. J. K. Hosp. No. 5551 age 54. The patient has enjoyed good health. Menstruation has been normal as to regularity and duration. She has had 8 children. One child is said to have weighed 20 pounds. This delivery was difficult and the cervix was torn. The patient applied for treatment on June 11 1918. The menopause had occurred five years before. Seven months ago the patient noticed an irregularly appearing discharge from the uterus which 3 weeks ago became bloody. She has had slight headache for years but she felt well and strong and has had a good appetite and her bowels were regular. Examination showed extending laterally to the right from the cervical canal a deep ulcer with elevated nodules. The lesion was hard. The uterus was not enlarged and was movable. There was no induration of the broad ligaments. Microscopical examination revealed pleomorphic epithelioma.

**Treatment** On June 12 1918 8 unfiltered minute glass tubes containing together 0 millicuries were embedded in the ulcer giving a dosage of 2640 millicurie hours also 3 tubes containing together 131 millicuries in 1 millimeter platinum were applied for 28 hours the tubes being arranged end to end and placed in the uterocervical canal. Following the treatment a rapid disappearance of the ulceration and induration took place.

March 15 1919. No ulceration but an increase in the size of the cervix has developed with greater restriction of the mobility of the uterus due to a diffuse infiltration of the base of the broad ligaments. A deep recurrence of the disease has taken place and the ultimate diagnosis is bad.



August 1915 she suffered a severe hæmorrhage. On October 12 1915 a panhysterectomy was performed and since then she has never felt well. Microscopical examination revealed carcinoma of the uterus.

**Treatment** On June 6 1918 5 unfiltered minute glass tubes containing together 15 millicuries were embedded in the nodules in the posterior vaginal walls giving a dosage of 1980 millieure hours. Present condition: There has been no further increase in the size of the nodules though the induration at their site has not completely disappeared. Her poor health since the panhysterectomy has not improved. The patient died apparently from internal metastases in the early part of January 1919.

**CASE 4** Recurrent carcinoma of the uterus improved by treatment. E. W. W. Hosp. No. 3421 age 62. The patient had enjoyed good health until 3 years ago. In April 1913 she noticed a prolapse of either the cervix or the walls of the vagina accompanied with bleeding from the vagina. In May she was curetted and under a diagnosis of carcinoma the uterus was removed two weeks later. She was free from all symptoms for the next 4 years when there was a recurrence of the bleeding. For this she was treated in Los Angeles with radium. The patient applied for treatment April 29 1918. Between April 3 1918 and May 8 1918 the patient received four treatments of 9 millicuries of radium: 1 tube in 5 millimeters silver and 13 millimeters of brass applied in the ulcer 14 and 16 hours each. Examination showed a small ulceration in the vault of the vagina. Microscopical examination showed recurrent carcinoma of the cervix.

**Treatment** On April 29 1918 1 tube of 1086 millicuries in 1 millimeter platinum was applied for 8 hours; the tube being covered by a rubber tube placed over the base of the ulcer. On July 1 1918 the induration had practically disappeared but in the vault of the vagina was an ulcer covered with slough which was due to radium necrosis. Following this there was a progressive improvement in the patient's condition; the ulcer healing; the discharge diminishing; and the tumor tissue being absent. January 1 1919 all rectal and bladder irritation had ceased but a blood tinged discharge was still present. March 18 1919 the ultimate prognosis in this case is probably bad though the presence of tumor at the present time cannot be proved. Her general health has been good since the radium treatment was begun.

#### CARCINOMA OF THE FUNDUS—4 CASES 2 IMPROVED FOR PERIODS OF 2 YEARS 2 CLINICALLY CURED 14 AND 21 MONTHS AFTER TREATMENT

**CASE 1** An early cancer of the fundus of the uterus. An apparent complete retrogression with no evidence of recurrence for 3 years after treatment. A. S. Hosp. No. 23320 60 years old. The patient

had an early cancer of the body of the uterus with retrogression after one treatment. Examination on admission June 5 1914 shows the uterus slightly enlarged. There is a bloody discharge from the cervix. The cervix itself is not enlarged or ulcerated. The patient is fat and suffers some from dyspnoea on exertion. Her arteries are thickened and tortuous. Microscopical examination shows adenocarcinoma. Five weeks ago the patient noticed a blood discharge from the vagina and an uncomfortable bearing down sensation. Three weeks ago she began to have pain in the back. These symptoms have gradually increased.

**Treatment** Under nitrous oxide the uterus was curetted and the curettines showed on section adenocarcinoma. A tube containing a small quantity of radium was inserted into the uterus for 6 hours. July 31 1914 a second treatment of 20 millicuries of radium was given for 8 hours. Following this treatment there has been no return of the menorrhagia nor any uterine symptoms whatever. The patient died in the summer of 1916 from apoplexy.

No examination was made later than a year after her treatment but the entire absence of uterine symptoms during the second year following treatment justified the conclusion that there was no local recurrence.

**CASE 2** Advanced carcinoma of the fundus clinically arrested for 2 years by radium treatment. C. C. Hosp. No. 21099 55 years old. The patient was admitted to the New York Hospital September 13 1914. The uterus and cervix were curetted. Both were found to contain much soft tissue. Examination per rectum showed that the growth had invaded the anterior rectal wall. Microscopical examination showed adenocarcinoma of the cervix and uterus. The patient entered the Memorial Hospital September 5 1914 at which time 25 millicuries of radium emanation were inserted in the cervix for 4 hours. She left the hospital much improved. She returned in about 6 months and not much improvement was noted since the previous treatment. The cervix was found to be enlarged once and a half its normal size and was hard. There was more or less vaginal discharge. Some restriction of the normal mobility of the cervix was noted. The base of the broad ligament was much thickened.

**Treatment** April 13 1915 1 tube containing 50 millicuries in 1 millimeter lead covered with rubber was applied in the cervical canal for 48 hours. Following this treatment there was vesical and rectal irritation which subsided in the course of a few weeks. The patient then steadily improved and became free from all symptoms of her disease. Examination February 13 1916 revealed a small shrunken cervix free from all ulceration and no evidence of disease involving the broad ligament. A few days before this examination she began to complain of a vague headache. About two weeks later she had pain and soreness in her right inguinal region followed by tenderness over the right kidney.



region The urine was scanty and high colored and upon examination showed a large quantity of pus cells and bacteria She had some nausea and vomiting but no rise of temperature Her general condition deteriorated rapidly and she died on March 16 1917

**Autopsy** An abscess was found surrounding the lower pole of the right kidney with extension to the wall of the renal pelvis and beginning purulent interstitial inflammation of the kidney The uterus was reduced to a nodule of tissue 2 by 1 by 1.5 centimeter and was surrounded by adherent intestinal coils and fused with bladder wall The vagina as shortened and thickened but smooth On section the uterus as found infiltrated by alveoli of adenocarcinoma or malignant adenoma in which the lining cells showed hydropic degeneration but the nuclei stained well Mitoses could not be found The muscle tissue was extensively fibrosed The rectal wall was fibrosed but free from cancer The bladder wall was infiltrated by scanty adenocarcinomatous alveoli over an area of 2 centimeters in diameter but the mucosa was intact

In this case we can at least say that a clinical cure of two years standing was obtained in an advanced cancer of the fundus of the uterus

**CASE 3** Operable carcinoma of the fundus clinically cured to date 1 month after one radium treatment C M B Hosp No 24889 age 40 The patient had had the usual diseases of childhood In 1900 she became ill with a severe attack of dysentery and precordial pain The trouble was later diagnosed as acute dilatation of the heart The patient as kept in bed for over a year on a very rigid diet and since this treatment has only had a mild attack of precordial pain and tachycardia The patient applied for treatment October 25 1917 In 1915 profuse menstruation developed and first attracted the patient's attention to her present condition The bleeding became more profuse and caused severe anemia Since August 1916 she has had four very severe hemorrhages Examination reveals a normal cervix with a somewhat enlarged movable uterus Microscopic examination of a section made of the curettings obtained October 26 1917 at which time the patient also received a radium treatment showed adenocarcinoma

**Treatment** On October 26 1917 2 tubes containing together 156 millicuries enclosed in 1 millimeter platinum and 1.5 millimeters rubber were applied for 8 hours in the cavity of the uterus Following this treatment the hemorrhage ceased and there was progressive improvement of the patient's condition A letter received from the patient March 24 1919 says that she feels better than she has for the past 8 years Menstruation has entirely ceased but the patient leads a sedentary life because of her cardiac condition and to this she attributes the abdominal tympanites accompanied with occasional pain in the stomach and abdomen July 22 1919 in telephone message patient states she is free from discharge and as well as previously

**CASE 4** Operable carcinoma of the fundus clinically cured to date 14 months after one radium treatment A W Hosp No 25442 age 62 The patient has enjoyed good health The menses have been regular and normal She has 6 children Births have been normal The menopause occurred 10 years ago The patient applied for treatment in October 1917 at which time a slight bleed occurred She received some local treatment but the bleeding recurred in April and she submitted to curettage Microscopic examination of the curettings showed adenocarcinoma

**Treatment** May 6 1918 2 tubes containing together 83 millicuries in 1 millimeter platinum were applied for 15 hours the tubes being arranged end to end in a rubber tube placed in the uterine cervical canal Advice from the patient March 1 1919 states that she is well and free from uterine symptoms July 11 1919 examination of patient shows an absence of all evidence of disease the uterus being practically normal

#### CARCINOMA OF THE EXTERNAL GENITALS—3

**CASE 3 CLINICALLY CURED TO DATE 21 TO 16 MONTHS AFTER TREATMENT WAS BEGUN 1 IMPROVED 1 UNIMPROVED**

**CASE 1** Primary carcinoma of the labium minor and urethra clinically cured to date 3 months after the first radium treatment A W L Hosp No 4830 age 69 The patient had never been seriously ill She applied for treatment October 8 1917 For over a year she had noticed a very slight vaginal discharge accompanied by very little discomfort Several years previously a small caruncle was removed from the urethra Several months ago the patient noticed a small mass which she thought to be another caruncle The mass was about the size of a pea and caused some burning during micturition Examination revealed upon the right border of the introitus a flat slightly raised tumor 2 centimeters long and 2 centimeters wide Its base and edge were hard and covered with neoplastic nodules and extended up and into the vagina to just within the vaginal orifice Microscopic examination showed epidermoid carcinoma

**Treatment** On October 9 1917 9 tubes containing together 248 millicuries in 1 millimeter silver were applied for 13½ hours the tubes being applied over the ulcer and held in place in a mold of dental modeling compound On January 8 1917 the induration had practically disappeared except for the small tumor like ulcers 0.5 centimeters in diameter June 1 1918 retrogression was almost complete except for a slight induration On June 9 1918 millicuries in 4 unfiltered minute glass tubes were embedded in the tumor mass giving a dose of 1214 millicurie hours Following this treatment the patient continued to improve and she failed to return for subsequent treatment until February 1919 when an indurated nodule was discovered in the site of the original lesion This as a part of the

a submucous recurrence and measured about centimeters in diameter. February 6, 1919, 5 unfiltered minute glass tubes containing together 16 millicuries were embedded in the substance of the tumor mass giving a dosage of 11 millicurie hours. March 12, 1919, the nodule had almost disappeared. July 1, 1919, examined and absolutely no evidence of disease present.

**CASE 2.** Primary carcinoma of the clitoris clinically cured to date 10 months after one radium treatment. I. S. Hosp. No. 25160, age 60. The patient has enjoyed good health. She applied for treatment January 1, 1918. Her present illness began in September, 1917, when she first noticed burning and a small swelling in the neighborhood of the right labium and clitoris. This swelling increased slightly in size to the present time and the burning sensation had become more disagreeable. Examination revealed in the anterior right labium minor two large nodules, centimeters in diameter. These were ulcerated on the surface and the two bases were broad and hard with deep infiltration of the underlying tissues. The anterior nodule involved the clitoris. Microscopical examination showed epidermoid carcinoma.

**Treatment.** January 1, 1918, 6 tubes containing together 303 millicuries in 0.5 millimeter silver were applied for 1.5 hours, the tubes being placed against the surface of the lesion, embedded in dental modeling compound, also 3 tubes containing together 93 millicuries without filtration were embedded in the tumor mass giving a dosage of 1327 millicurie hours. Following the treatment there was a gradual disappearance of the induration. On September 30, 1918, there was no evidence of the disease. July 11, 1919, there was still no evidence of disease.

**CASE 3.** Advanced carcinoma of labium minor. Death from erysipelas following treatment by burned emanation. I. S. A. Hosp. No. 5164, age 65. The patient had scarlet fever and diphtheria when a child. She has never been very strong. During the past few years she has been troubled with almost constant diarrhoea. The patient applied for treatment January 9, 1918. One year ago she noticed a small ulcer on the right labium unaccompanied with pain but causing itching and burning. Last September a discharge developed which has gradually increased to the present time. Examination showed upon the right labium an ulcer 2.5 centimeters in diameter. There was also a large nodule in the right inguinal region 1 centimeter in diameter. Microscopical examination showed epidermoid carcinoma.

**Treatment.** January 29, 1918, 2 unfiltered minute glass tubes containing together 1, 1 millicuries were embedded in the base of the ulcer giving a dosage of 2240 millicurie hours. Following the treatment the patient developed erysipelas from which she died March 8, 1918. At the time of death there was an almost complete disappearance of the induration at the primary site of the disease.

**CASE 4.** Primary carcinoma of the urethral meatus and labium minor clinically cured to date by 3 radium treatments. Duration 16 months after the first treatment. J. H. Hosp. No. 5283, age 4. The patient had diphtheria when 12 years old. A large fibroid was removed from the uterus 8 years ago. The patient applied for treatment March 1, 1918. Three months ago she had noticed first a slight vaginal discharge which at first was intermittent and later continuous. Two months before application for treatment she noticed a soreness in the labia minora. Six weeks ago micturition became painful and these symptoms have increased slightly to the present time. Examination shows surrounding the urethral meatus and destroying the anterior two thirds of the right labium minor an ulcer with an indurated base and papillary surface 5 centimeters in diameter. The anterior border involves the clitoris. The induration of its base is deep seated and extends centimeters upward into the superior vaginal wall. Microscopical examination showed epidermoid carcinoma.

**Treatment.** On March 14, 1918, 5 unfiltered minute glass tubes containing together 113 millicuries were embedded in the base of the ulcer giving a dosage of 1491 millicurie hours, also 5 tubes containing together 1523 millicuries in 0.5 millimeter silver were applied for 3 hours against the ulcer in dental modeling compound. On July 1, 1918, 1 unfiltered minute glass tube containing together 15 millicuries were embedded in the residual induration giving a dosage of 1980 millicurie hours. Following the first two treatments the patient gradually improved until July when the ulceration was almost healed but there remained considerable induration. Following the treatment in July improvement continued until January 1919 when all evidence of the disease had disappeared with the exception of a small pea sized nodule of doubtful significance in the posterior right labium. To insure safety this was treated on January 16, 1919, 2 unfiltered minute glass tubes containing together 78 millicuries being embedded beneath the nodule giving a dosage of 1129 millicurie hours. March 1, 1919, nodule undergoing rapid disappearance. July 7, 1919, no evidence of disease.

**CASE 5.** Advanced carcinoma of labia majora held in check for 1 year by two radium treatments. M. E. H. Hosp. No. 5434, age 57. The patient has enjoyed good health except for the usual diseases of childhood. She applied for treatment May 3, 1918. One year ago she noticed itching of the vulva. This increased in severity and later was replaced by burning and severe irritation during micturition. Several months ago an ulcer was located in the labia which was treated with local application. Examination of the left labium major shows a large elevated flattened ulcer. It measures 5 to 6 centimeters in diameter. The base is hard and covered with neoplastic nodules. There are enlarged glands palpable in the groin. Microscopical examination shows epidermoid carcinoma.



the results of the treatment of uterine cancer with radium is a consideration of the methods by which these results have been obtained

The majority of radium therapists in gynecology use single tubes. These are inserted inside the uterus or within the cervical canal or against the vaginal surface of the cervix or in several of these locations at the same time or at alternate treatments.

The dosage generally used has been heavy, sufficient to cause extensive sloughing and is usually too heavy for almost any other region of the body. Bumm for instance recommends a total dosage of 8700 milligram hours to 15,000 milligram hours.

Cheron and Rubens Duval use the Dominici tubes wrapped in gauze and placed in the vagina and give 48 to 7200 milligram hours repeating this treatment when they deem it necessary.

Schauta recommends the use of 50 milligrams filtered by millimeters of lead applied for five days or 6000 milligram hours and the repetition of this dose in ten days, thus giving thus virtually 1,000 milligram hours. In eleven cases he has had two severe hemorrhages, one vesicovaginal fistula and one rectovaginal fistula.

Schundler uses as small a quantity of radium carbonate as corresponding to 7 milligrams of pure radium bromide. This is enclosed in a lead capsule 13 millimeters thick and placed within the vagina for days.

Scherer and Keley filter through 13 millimeters lead and use a total dosage of 38,000 milligram hours.

Latzo and Schueler use the Dominici tubes of 0.5 millimeter silver covered with 1 1/2 to 3 millimeter lead and a dosage of 15,300 to 16,800 milligram hours.

Doerderlein gives 1,000 to 14,000 milligram hours in divided doses in the course of 1 to 2 months.

Dobbert recommends 400 milligram hours repeated every third day until 6000 to 7000 milligram hours have been given. He filters through gold and brass rarely through lead.

Weinbrenner gives 8004 to 13,680 milligram hours and filters through silver.

Alman uses 150 to 100 milligrams of

radium bromide for 24 hours 3600 to 4800 milligram hours repeating the treatment at intervals of two to four weeks. He uses nickel plated brass filters. He had severe symptoms in a number of patients from over dosage.

Burrows uses a strong application within the cervix 50 to 60 millicuries of emanation filtered through 1 millimeter of silver and simultaneously two to three needles containing emanation thrust into the broad ligaments and posterior lip of the cervix left in place 24 to 48 hours.

This treatment is further reinforced by the application of varnish plates over the abdomen.

Kelly and Burnam have not yet described their technique.

St. Clair has successfully used as small a quantity as 10 milligrams of radium applied within the cervix and uterus six times at intervals of 6 to 8 days for 4 hours each time a total dosage of only 1440 milligram hours.

Sir Thomas Oliver obtained his excellent result from a single application of 24 hours duration of a single tube of emanation containing probably 50 to 100 milligrams of emanation in other words 100 to 2400 milligram hours.

Von Graff reports severe effects from over exposure. He used at first 250 milligrams and later 40 milligrams for 24 to 48 hours. This is repeated once or twice at intervals of 2 to 3 days and of a second series of exposures given in two to three weeks. This probably represents 1000 to 2000 milligram hours at each exposure. He reports no bad effects from his later weaker dosage.

Schmitz who has furnished a very favorable report uses 50 milligrams radium element for 40 to 48 hours giving as a rule two treatments 12 to 36 hours apart. This amounts to 2000 to 4000 milligram hours. The radium is filtered through brass 12 millimeters thick. It is divided into two tubes arranged tandem. These are applied within the cervix and reinforced by crossfire from a second application of two tubes arranged side by side and applied against the cervix. Thus the total milligram hours amounts to 4000 to 4800.

milligram hours This treatment is repeated in three weeks time but only if there is no great change If improvement occurs the consideration of further treatment is postponed for another three weeks Schmitz also cites experiments on cutaneous nodules of breast cancer which demonstrated that the  $\gamma$  rays from 50 milligrams of radium element applied for 12 hours (600 milligram hours) will destroy carcinomatous tissue 1 centimeter distant

Clark describes his dosage only in connection with uterine myomata and here refers to 50 milligrams for 4 hours or 100 milligram hours as a large dose for the interior of the uterus We assume that he uses a similar dosage for cancer

Bailey formerly used a dosage of 3000 millicuries in the vagina applied to the cervix and filtered through 1 millimeter platinum A tube of 600 millicurie hours is applied within the cervix and 600 millicurie hours directed toward each parametrium In addition to this 3000 millicurie hours is applied over the abdomen in three places over the center of the abdomen and over each inguinal region He now uses 1000 millicurie hours in one platinum tube placed in the cervical canal and 3000 millicurie hours from his bomb directed in fractions of 1000 millicurie hours each in three different directions against the cervix and a total of 18000 millicurie hours applied externally at a distance of 4 centimeters from the spine over six different areas in a circle around the pelvis i e 3000 millicurie hours over each area

Recasens uses 70 milligrams of radium for 20 to 24 hours He has used 10 milligrams for as long as four hours In other words 1400 to 1680 or even 6240 milligram hours This treatment is repeated after an interval of 8 days and again a third time after another 8 days It is again repeated after 60 days and sometimes altogether six or eight applications are made two months elapsing between the later applications

Of these methods of treatment that of Schmitz corresponds more closely than the others with our own We believe it important in the treatment at least of cervical cancer to crossfire from within the cervical canal

and from the surface of the ulcer Moreover we cannot understand the heavy dosage recommended by many of those whom we have quoted

In our experience one treatment appears to be all that is required in many cases The two cases which we here report having gone the longest time one of them 3 years and 4 months and the other 3 years have each received only one treatment

For the average favorable case 6000 millicurie hours in one treatment may be all that is necessary while a repetition of this treatment at too soon an interval or increasing it may cause the patient much unnecessary discomfort or produce fistulae

The radium should be divided equally among six tubes These tubes may be the regular Dominici tubes of 0.5 millimeter silver but we prefer tubes of 1 millimeter platinum The tubes which we use are 2 centimeters long with a central radium containing portion  $1\frac{1}{4}$  centimeters long and walls 1 millimeter thick Such tubes have the filtering power of millimeters of lead and are less bulky

While the Dominici tube filters out practically all the  $\alpha$  and  $\beta$  rays it does not filter out many of the soft  $\gamma$  rays One millimeter of platinum or 2 millimeters of lead filters out also the softer  $\gamma$  rays One millimeter of platinum or 2 millimeters of lead permits therefore the use of a much larger percentage of deeply penetrating radiations which are far more homogeneous Radiations from radium filtered in this manner must be used for a longer period and so used will exert a far more distant effect and a much better defined selective action

For cancer of both the fundus and the cervix we advise the use of three of these tubes containing 150 milligrams of radium and inserted in the uterocervical canal arranged end to end in a long rubber tube For cancer of the cervix three additional tubes are placed against the cervical ulcer The tubes placed against the cervical ulcer should be distributed evenly over its surface and the best method of retaining them in such a position is by embedding them within a mold of the cervical ulcer and vagina made of

dental modeling compound. This compound is the preparation which dentists use for obtaining impressions of the teeth. Placed in hot water it becomes soft like putty and in this condition may be inserted into the vagina. Left there it cools to the body temperature at which it becomes hard enough to retain its shape. It forms therefore a perfect mold of the interior of the vagina and may be easily removed and reinserted and when reinserted it always finds the same position in the vagina. Upon this mold is an impression of the cervical ulcer. The three radium tubes may be embedded at equal distances from each other within the area of the mold which shows the impression made by the cervical ulceration. When the mold then is reinserted into the vagina these tubes come into accurate apposition and are evenly distributed over the ulcer. This mold serves an additional function in holding the vaginal walls and with them the bladder and rectum away from the cervix and the radium lying against it and thus protects these organs from burning. If the radium is so placed that it comes into dangerous proximity to the bladder and rectum a piece of lead may be embedded behind it in the opposite surface of the mold thus still more completely insuring the protection of the bladder and rectum. An absolute protection of the bladder and rectum and overhanging vaginal walls is not desirable. Schottlaender and Kermauner have shown that in a definite percentage of cases of cancer of the cervix metastatic extensions are already present in the vaginal walls at some distance from the cervix. It is therefore not desirable to protect the vagina too strongly when applying radium to the cervix.

Some protection is advantageous because in its absence disagreeable bladder and rectal tenesmus and discomfort from burning in the vagina can follow strong applications to the cervix. The cervix itself is practically insensitive to strong treatment. I have found that the separation of the vaginal walls by the dental molds is sufficient and yet allows a desirable amount of radiation of the vagina.

Special provision for directing strong radiations against the broad ligaments with a

comparative neglect of the anterior and posterior parametrium is probably unsafe as compared to a uniform radiation of all the parametrial tissue.

Schottlaender and Kermauner have shown that the regions in front and behind the cervix are frequently involved by the direct extensions of the growth.

The distribution of the radiations should therefore be made as diffuse as possible around the cervical ulcer as a center.

Attempts to supplement the internal treatment of uterine cancer for the purpose of more effectively reaching extensions into the uterus, broad ligaments and lymph nodes by the application of heavily filtered radium over the abdomen are of undetermined value.

Bailey in his excellent work uses such cross firing through the abdomen in all his cases. Levine and Koernig have good results from crossfiring by X ray radiations. My own experience in the treatment of epidermoid cancer in the deep cervical lymphatics where the effects of the treatment can be followed with greater accuracy and in a few advanced cases of uterine cancer confirms the experience of these men and indicates that a definite additional impression is made upon the extensions of uterine cancer by crossfiring through the abdomen. We are not therefore justified in neglecting this accessory means of treating uterine cancer. Nevertheless its importance must not be overrated for there are some objections to its use. When the crossfiring is given by radium and this is the agent of choice because its radiations are more penetrating than the X ray radiations large quantities are needed. These quantities are only available in a few stations. Moreover their use prevents the treatment of other patients. The X rays which will be further improved in the future are a more practical means of crossfiring uterine cancer through the abdomen but even the use of these rays seriously complicates the treatment for many patients.

Until therefore the indications for the use of crossfiring through the abdomen are more thoroughly understood until we know how much more it accomplishes than palliative improvement a failure to be able to give it

should not be regarded as a contra indication to the treatment of uterine cancer by local applications alone

It must not be forgotten that uterine cancer when still limited to the regions of its primary appearance is curable by these local applications alone. None of the cases for instance in this report has received any other treatment

The dosage which I have found safe and efficient in cancer of the cervix the radium being distributed as above described is 6000 millicurie hours. i. e. divided into 3000 millicurie hours within the uterus and 3000 millicurie hours against the cervix. In other words it is recommended that the radium should be divided into 6 tubes for the treatment of cervical cancer and if each tube contains 50 milligrams 3 of the tubes arranged end to end are placed in the uterocervical canal for 20 hours and the other 3 against the cervical ulcer for the same length of time

One of these treatments may cause a complete retrogression and a repetition of the treatment may not be necessary. In our experience the best results have been obtained when a repetition of the treatment was not necessary

Theoretically this is so and should prove so practically for just as the success of the removal of the cancer by operation is best when the removal is complete so every effort should be made completely to destroy carcinoma of the uterus by one blow when it is first seen and therefore most limited around the site of origin. If repetitions of the treatment become necessary a long interval should elapse and much care used in making the second treatment, as the tissues will not bear the same dose a second time so well

We believe there is some advantage in cervical cancer in the use of emanation enclosed within minute glass tubes which are embedded in the tumor mass instead of the surface application of radium

We recommend the use of 10 to 30 or 40 millicuries of emanation according to the size of the tumor treated distributed as evenly as possible throughout the tumor. Bagg has shown that 1 millicurie will produce a general

necrotic effect through a sphere of tissue surrounding the tube for a distance of 1 centimeter. It is important therefore that the amount of emanation in each tube should be reduced to a minimum consistent with the avoidance of objectionable trauma dependent on the introduction of too many tubes. The dose from 10 to 40 millicuries of emanation is 640 to 5280 millicurie hours

From our experience with unfiltered emanation in other regions of the body the intense shower of  $\beta$  and soft  $\gamma$  radiations having it is true a more limited radius of effectual activity produces a more complete destruction of cancer than the more penetrating  $\gamma$  radiations alone. These are more accurately applied and distribute the radiations more evenly through the cancer tissue and subject the patient to less inconvenience than any other method of treatment

A review of the cases reported in this paper does not of course prove that radium is at the present time the method of choice for treating primary carcinoma of the fundus or cervix uteri. Taken however in conjunction with the other reports in the literature above quoted it suggests that in only a few years there will be ample proof that radium is the method of choice in the treatment of cancer of the uterus at least of that most frequent form of cancer of the uterus and most difficult to manage by operation cancer of the cervix

The presentation of the evidence furnished by this report may therefore be premature in so far as operable cancer of the uterus is concerned. It is however conclusive for cancer of doubtful operability but so strong for operable cancer of the cervix that in the light of the other published observations the treatment of early cancer of the cervix by radium is at the present time justified

More than this it suggests that it is unjust to the women of the country to wait 3 to 5 years longer before the widespread distribution of radium throughout the country is planned for

Each medical center in the country should plan to own sufficient radium to care for at least the uterine cancers of its district. While it is desirable that sufficient radium should be purchased by each of these centers to permit

the use of emanation and thus supply be placed under the care of a trained man who can properly become responsible for its use by the physicians of the district concerned yet for the treatment of uterine cancer alone the use of emanation is not an absolute necessity. The treatment used in the vast majority of the cases thus far reported and in the author's earlier cases those having remained well the longest has not been by emanation and is quite within the power of the private owner of radium. This treatment has proved efficient. In the later cases the author has preferred the combination of filtered radium emanation with the embedding in the cervical ulceration of unfiltered emanation tubes. The advantages offered by this combination at least in treatment of uterine cancer may be sacrificed when the use of radium itself is only possible. These facts are important because they make practical the treatment of cancer of the cervix generally throughout the country.

When we consider that at a conservative estimate 8000 to 9000 women die of carcinoma of the uterus each year in the United States<sup>1</sup> and that a search, as elaborate as can be made through the published reports including as these reports do circular letters sent out by Cullen and Taussig through the South and West in the United States finds only 61 women operated upon five years prior to 1916 who have been cured of carcinoma of the cervix uteri can any consideration justify the postponement of the general use of radium in the treatment of uterine carcinoma? While of course more than 61 women up to 5 years ago have been cured by operation of cancer of the cervix in this country yet it is safe to say that this number indicates what a drop in the bucket the operative treatment of cancer of the cervix uteri is toward meeting the real demands of this malady upon the medical profession. But granting that the radical abdominal operation could cure 100 per cent of the operable patients of cancer of the cervix applying for treatment there are not in the country a

sufficient number of capable surgeons to do the required work.

Contrasting with this record the record which radium has already made however immature this record may be the fact that it has produced cures of two to four years standing in cases too extensive for operation that it has produced cures of three years standing and over in a larger percentage of early cases than operation has produced one author claiming for it in this stage 100 per cent of cures the fact that treatment by it in no way interferes with the patient's routine life and subjects her life to no risk the fact that it is a remedy capable of being used by any one possessing the simplest gynecological training after receiving certain easily acquired technical instruction contrasting these facts with the operative records is not the time ripe to urge each county medical society to make the effort to place a supply of radium in its district? Three hundred milligrams are sufficient for the treatment of one case every 24 hours. Less may be successfully used but if so the treatments must be longer and the number of cases treated less.

Aside from the relief in advanced cases can there be any doubt that if such a plan be carried out more cases of cancer of the uterus would be cured than are now saved by operation and a knowledge of this fact soon go further in inducing women to seek help in an early stage than are at present induced by the attractions of a radical abdominal operation?

The strong argument for the radical abdominal operation has always been the fact that it is the only method by which lymphatic metastases may successfully be removed and yet few of the cases with such metastases have ever been cured by operation.

Weibel of the Wertheim clinic states that 25 per cent of all cases upon which he operated had cancerous glands and nearly all died of recurrences. In his whole series only ten such cases remained well five years.

Simpson reports one case cured in which a metastasis was found in the lymphatic gland.

Clark states that if the higher pelvic lymphatic systems are the seat of metastases it is scarcely possible for the widest and most

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painstaking dissection to completely eradicate it

None of Busse's cases in which the presence of carcinoma in the lymphatics was demonstrated ultimately recovered

Hofmeier saved no case in which the removed glands contained carcinoma

Schottlaender and Kermauner state on page 456 of their book on carcinoma of the uterus based on the 256 operations of von Rosthorn's clinic that in the later years not much importance was attached to the necessity of removal of glands and in the review which the author gave this book he found no case which ultimately recovered in which the glands removed contained carcinoma

We may conclude then that only isolated cures can be obtained by any method when the cancer has left its primary site so that any error made in neglecting attention to the higher pelvic lymphatic glands is more than offset by higher mortality accompanying attempts to remove them

Cancer of the cervix in probably the majority of cases displays a strong disposition to remain localized for a long period Zweifel for instance records 3 operations for recurrent cancer of the cervix of which 7 were free from further recurrence seven and a half years

If cases with cancerous lymphatics can be cured it is far better to attempt to do so by opening the abdomen after treating the primary disease with radium and embedding emanation in the enlarged glands We have evidence in our work with radium in the mouth that its effect extends to the first set of regional lymphatics

From the therapeutic standpoint cancer of the uterus must be regarded as a local disease and the most practical method of handling the disease at its site of origin must be adopted

Our present evidence indicates that radium destroys the disease at this site to a greater distance than the knife is capable of removing it and does this with no risk or inconvenience to the patient and only a small tax on the skill of the surgeon Every effort should therefore be made to secure its general use throughout the country

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## SECONDARY MELANO-EPITHELIOMA OF THE BLADDER

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MELANO EPITHELIOMA is always primary in the eye or in pigmented moles of the skin and it metastasizes so rapidly that the patient succumbs soon after the appearance of the growth. The extreme rarity of its occurrence in the bladder seems to warrant the report of the clinical history and subsequent course of the disease in a case under our observation. Mention has been found in the literature of but one similar case.<sup>1</sup> The history of our patient is as follows:

Case 858, a man aged 45. The patient's mother died of cancer of the stomach at the age of 73 and like the patient she had had pigmented moles regularly distributed over the entire body. For the past five or six years the patient had noticed that a rather large mole situated on the right side of the abdomen near the umbilicus had a color of ganglionic debris which could be pressed and two months previously it had begun to enlarge and had a tendency to bleed. Because of the bleeding the patient consulted his physician who excised the growth. Histologic examination revealed melano-

epithelioma. Further surgical advice was sought and the examination was negative except for slight enlargement of the inguinal lymph nodes. The urinary findings were negative. A gland removed from the groin was found to be malignant in character and therefore all the lymphatic glands in both groins and Scarpa's triangle were removed. The external saphenous vein was ligated. While the patient was convalescing from the operation radical treatment was begun and was continued at frequent intervals. Eight months later another small gland in the inguinal region was discovered which proved to be of the nature of those previously removed. Ten months later increased frequency of urination and diminution in the size of the stream and nocturia were noticed. The urine contained a number of erythrocytes and pus cells.

On cystoscopic examination multiple areas of black rounded tumors varying in size from 1 to 5 centimeters were found on the right base of the bladder anterior to the right meatus. On the left all two of the tumors had pedicles the others were sessile.

As soon as the bladder condition was discovered intravesical radium treatment was instituted. To the present time 400 milligram hours have been given. At the last cystoscopic examination one month ago no material change was noticeable except perhaps a slight increase in the size of one or two of the tumors.

T. G. J. H. Sec. d. r. y. m. l. t. sarcom. ith. bl. d. T.  
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# SACRAL SUSPENSION OF THE UTERUS FOR THE RELIEF OF PATHOLOGICAL MECHANICAL RETROVERSION AND DESCENSUS<sup>1</sup>

BY JOHN VAN DOPEN YOUNG M.D. F.A.C.S. NEW YORK

THE general subject of retroversion of the uterus has been voluminously treated in medical literature and views of great diversity have been expressed as to its etiology importance and pathology. Much confusion exists in the medical mind as to the normal as well as the pathological position of the uterus if one may judge from the writings and discussions of those who are accepted authorities in gynecology. Some writers go so far as to state that a pathological position of the uterus is normal in some women. There can be no question that some suffer less from a given pathology than others but that does not make it normal even in those cases. There is a normal position of the uterus and there are variations that are within physiological limits but there is a point beyond which lies the area of pathology.

In defining and passing on the importance of abnormality of position of the uterus several factors must be considered (1) age of patient (2) position of the body at the time of examination (3) skeletal poise (4) muscular development (5) birth trauma and (6) occupation.

1 *Age of patient* For the gynecologist woman's life is divided into three stages first before childbearing second during childbearing and third after childbearing. It is manifest that these three stages will have distinct gynecological conditions that fact must be recognized before the examiner can determine the actual or relative normality of a given case.

A patient in the first stage suffering from retroversion causing relative sterility future years of menstrual disturbances and raising troublesome marital questions would demand relief when the same degree of deformity could well be disregarded after the menopause.

Furthermore the changes of the period of childbearing and the postmenopause atrophy present conditions that must be analyzed

2 *Position of the body at the time of examination* I desire to call particular attention to the fact that an examination in both the dorsal and the standing positions is absolutely necessary in judging of the importance of a retroversion of the degree of descensus and of the result of an operation.

3 *Skeletal poise* The study of skeletal poise is essential to the understanding and to the treatment of all posed conditions of the viscera. Uterine ptosis is no exception to this rule.

The ill effect of faulty poise is far reaching and its correction is absolutely essential. But while faulty poise can put too great a strain on the ligamental supports of the uterus thereby lengthening them its correction can not shorten them if they are stretched beyond their elastic limit.

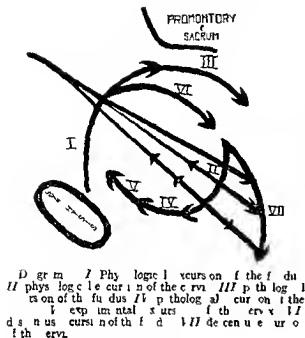
4 *Muscular development* Muscular tone as a part of a generally well developed body is a direct advantage to a patient but in a pathological mechanical retroversion or descensus of the uterus I have seldom seen any improvement in uterine position from improvement in general health or muscular tone. It is my opinion that as many retroverted posed uteri are found in well developed women as in poorly developed women.

5 *Birth trauma* Birth trauma is of the greatest importance as a contributing cause in retroversion and descensus.

Subinvolution means increased weight and bulk to the uterus lax ligaments and therefore less resistance to positive intra-abdominal pressure and greater surface to receive this pressure.

At this point allow me to call your attention to the fact that the uterine ligaments are amply strong enough to hold a normal uterus in normal position with a normal body poise and an intact pelvic diaphragm but the resistant margin beyond this is not great.

Cervical birth trauma with resultant in



section and enlargement of the cervical arm of the uterine lever distorts uterine balance and predisposes to general uterine enlargement and consequent overweight.

Injury to the rectovaginal and vesicovaginal endopelvic fascia with rectocele and cystocele pocketing of the rectal and vesical contents straining to empty the organs and lack of fascial support are the most easily recognized causes of retroversion and descensus. The laceration of the superficial perineal muscles with the tearing away of the sphincter ani from the conjoined tendon increases the predisposition to rectocele.

Separation of the levators with lateral retraction of these muscles and thereby a loss of pelvic diaphragmatic support is a most important link in the chain of birth injury.

6 Occupation All standing occupations predispose to faulty pose and therefore show an increased proportion of retroversion and descensus.

The contributing causes are constipation tight or faulty corsets lack of attention to the emptying of the bladder especially during the menstrual period abortions falls especially in the sitting posture lifting and carrying of heavy weights horseback riding.

My conception of what might be called the absolutely normal position of the uterus is

shown in Figure 1 a young woman with empty bladder and bowel the patient in the standing posture. Variations from this picture are well within physiological limits and variations of even a greater degree are compatible with health. Note the position and axis of the vagina and of the uterus and the acute angle produced by the meeting of these axes. Note also the uterosacral ligament observing its course and general character the round ligament its position as a guy rope to the fundus and the direction and uselessness of these ligaments for support in the standing position.

For convenience of description I divide retroversions into two classes physiological and pathological. These two conditions blend and by easy stages merge into the condition of descensus which is the predecessor of prolapse. See Diagram 1 which depicts the lines of excursion of the fundus and cervix in all four of these conditions.

Physiological retroversion is the condition in which the fundal excursion does not go below the promontory of the sacrum and where the cervical excursion is in proportion.

Pathological mechanical retroversion may be described as a retroversion of the fundus a moving forward of the lower segment and a descensus of the whole organ (see Figure 1). Note that in this position the fundus is below the promontory of the sacrum and presses on the rectum between the uterosacral ligaments with resultant fecal stasis.

The cervix impinges on the trigone and is lifted out of the seminal pool with consequent relative sterility the vagina is shortened and the upper portion displaced forward in the pelvis and it becomes perpendicular when the patient is standing.

The adnexa are prolapsed in the pouch of Douglas. The bladder fundus is pulled back by the uterus and is left free to rise into the abdomen and is exposed to intra abdominal pressure in a disadvantageous position. The fundus is posterior the cervix is anterior the anterior or inferior surface becomes the superior the posterior or superior surface becomes the inferior.

The venous return is impeded by the twisting of the broad ligaments with con-

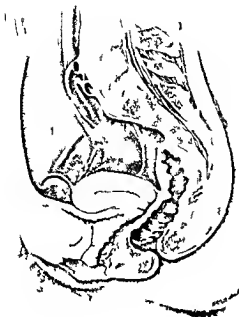


Fig. 2. Normal position of the uterus in a woman with empty bladder the patient standing.

sequent varicosities of the pampiniform plexus. The infundibulopelvic ligaments are dragged over the edge of the true pelvis obstructing the venous return and there is a consequent circulatory stasis of both uterus and adnexa.

The axes of the uterus and of the vagina often form an obtuse angle or the uterine axis is pushed back until they form a straight line or a reverse angle even greater than a straight line.

Figure 3 shows the relation of the normally placed organs viewed from above. Figure 4 shows pathological mechanical retroversion viewed from above.

The next malposition of the uterus which we are to consider is descensus. This deformity may be preceded by a retroversion or the early stages may precede or may be synchronous with the accompanying retroversion. In any event the two misplacements are associated and the downward course of the uterus is due to a marked yielding of the uterosacral swing which places the uterus in the axis of the birth canal where intraabdominal pressure is the greatest and the ligaments

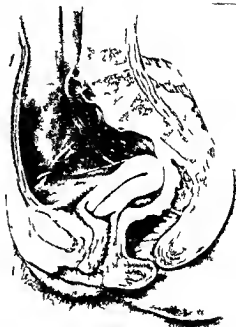


Fig. 3. Pathological mechanical retroversion on

are least able to resist it. It must also be noticed here that the curve of the descensus is changed both in the fundal and in the cervical arc from that of retroversion as the fundus nears the sacrum and the downward course is explained by the loss of the support of the uterosacral ligaments.

I have found one other group of cases namely those in which the uterus seemed in normal position in the dorsal examination but in which on looking further for the cause of the backache I found that with the least amount of effort the cervix could be placed in the extreme experimental position (see Diagram 1) and that in the standing position there was well marked descensus showing a marked loss of the uterosacral support. I believe this is an important condition which should be recognized as these patients suffer greatly.

One other condition which I wish to mention is that of intermittent retroversion of the physiological and pathological classes. This condition is present where the balance of ligamentary resistance and intraabdominal pressure is wavering and where part of the time the ligaments are not equal to their task.

Following in natural sequence upon descensus is prolapse which is a change of degree only and not of kind.

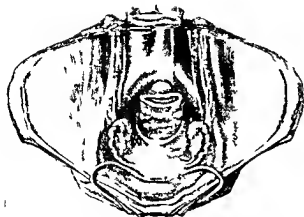


Fig. 3 Rlt fth m lly pl d g d f m b

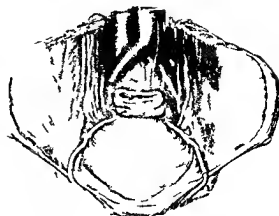


Fig. 4 Pth l m h l t rs d f m b

The influence of pregnancy must be taken into consideration in the study of the cases and may be briefly outlined as follows: a retroversion or descensus which antedates a pregnancy is not benefited thereby, but often made worse. A postpartum retroversion on the other hand may often be permanently relieved if treated and the uterus replaced during the later involution period and a properly fitting pessary introduced and worn long enough to insure a return to normality.

In regard to the frequency of occurrence my tabulation of the 6134 cases examined shows retroposition in 238 cases or 37 per cent which is in accordance with the usual experience (see Table I). A relative sterility is found less than children per family.

Symptoms are due to pressure and pelvic stasis. They are backache, bearing down pains, dyspareunia, mental irritability, to melancholia, relative sterility, constipation.

Treatment is divided into general, local, pessary and operative.

The first two must, and often the third may precede operation as preparatory thereto.

Pessaries are also of use in cases where for any reason operation is contra-indicated and also in postpartum cases.

#### OPERATION

I desire to emphasize the fact that an operation to bear the test of time must take into consideration the anatomy, physics

mechanics and dynamics of the pelvis and to ask you to remember that there are very marked changes in the pelvic structures during and after childbearing.

The vital point is this: we are engaged in reconstructive surgery which must be based on correct theories.

Contemplating operation, one must recall that the uterus is a ligamentally hung organ in the bony pelvis below which is the muscular and fascial pelvic diaphragm, the function of which is the reception of intra-abdominal pressure and the support of the rectum and the bladder.

Now bear in mind that this pelvic diaphragm is injured by childbirth as follows: first superficially by laceration of the sphincter vaginae of the transversus perinei by injury to the conjoint tendon and retraction of the phincter; and second by laceration with separation and lateral retraction of the levator. Laceration of the vesicovaginal endopelvic fascia with cystocele; laceration of the rectovaginal endopelvic fascia with rectocele; any variation or combination of the above or a complete laceration that opens into the rectum.

Note also that retroversion and descensus occur in those who have never been pregnant.

If therefore retroversion and descensus occur independently of birth trauma then it would seem logical that the repair of the trauma could only be expected to relieve uterine deformity developed subsequently.

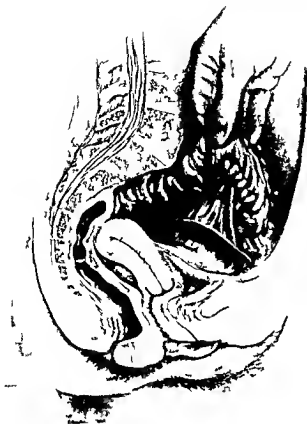


Fig 5 Perisigmoidal adhesions necessitating freeing of the sigmoid

and not prior to the injury and in those cases only where the ligaments have not been stretched beyond their elastic limit.

Experience alone will enable one to judge whether in a given case relief may be expected from repair. This experience must be applied with great care to borderline cases and intermittent retroversion as I am convinced that herein lies the cause of much confusion of views.

From the above the conclusion may be drawn that the benefit accruing from pelvic diaphragmatic repair is relative to that structure only and that the uterus must rely on its ligaments alone for support.

The uterine ligaments chiefly concerned in retroversion and descensus are the utero-sacral and the round.

The importance of the uterosacral ligaments in operations for the relief of these conditions was stressed in my first paper on this subject read before the New York Obstetrical Society in May 1903 and printed in the *Medical Record* of October 4 1903 again

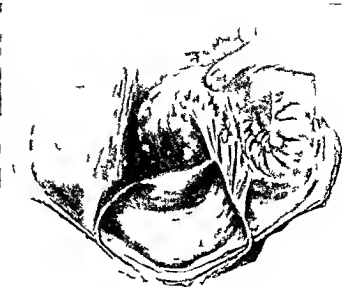


Fig 6 Ierisi moidal adhesions

in my second paper on this subject read before the Section on Obstetrics and Gynecology of the New York Academy of Medicine 1906 again in a third paper read before the First District Branch of the New York State Society and printed in the *American Journal of Surgery* in March 1909 and again in my fourth paper read before the Medical Society of the County of New York October 5 1915. In each succeeding paper I have expressed an ever firmer conviction that this theory is fundamentally correct. Now after twenty years of work I am of the same opinion.

The uterosacrals arise laterally from the corporocervical junction of the posterior wall of the uterus. Their direction is upward and slightly backward and the ligaments are inserted into the anterior surface of the first and upper edge of the second sacral vertebra. The fibrous tissue which enters into their formation is the thickened very strong edge of the pelvic fascia as it separates to allow the rectum to pass through.

For our purpose they may be divided into three parts: the uterine third, the middle third, and the sacral third. The uterine third is rounded and contains more muscular and elastic tissue. The middle or weakest portion, mostly fibrous, is the part where the yielding of the ligament occurs. The sacral third is fan-shaped, very strong, and is composed solely of fibrous tissue. The e liga





Fig. 1. (Continued)

ment are covered by peritoneum. The function of these ligaments is suspensory alone and they are the only ligaments that run (when the patient is in the standing position) from the uterus to the bone above.

The round ligaments are the guy ropes to hold the fundus forward and downward when the patient stands.

To summarize my conception of the indicated surgery is as follows:

In nullipara for physiological retroversion round ligament shortening for pathological mechanical retroversion and descensus cervical suspension and if needed round ligament shortening when there is a conical long cervix the tracheloplastic operation of Sturm-dorf.

In multipara the restoration of all birth trauma dilatation and urethragia indicated for the hypertrophied infected lacerated cervix the tracheloplastic operation for cystocele the restoration of the vesico-vaginal endopelvic fascia by the method of Rawl for rectocele the restoration of the recto-vaginal endopelvic fascia and the muscular interposition perineorrhaphy.

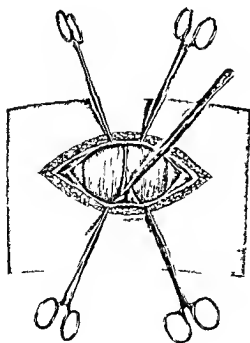
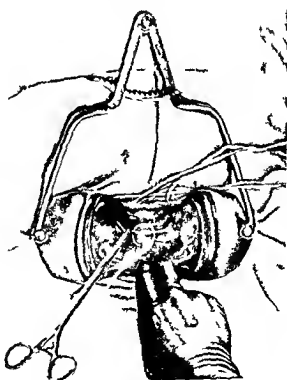


Fig. 2. Cervical



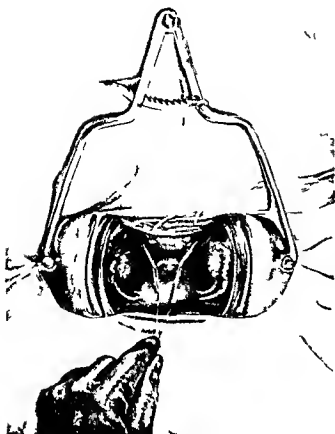


Fig. 10. The suture passed through the bases of the uterine sacral ligaments serve to purpose that they hold the uterus out of the way without injury to it and they bring the ligament into view.

#### SACRAL SUSPENSION

The incision of choice is the curved Pfannenstiel shown in Figures 7 and 8. After the abdomen is opened the patient is placed in the extreme Trendelenburg position and the intestines are gravitated into the abdominal cavity and held in place by oil impregnated pads. All gauze wipes that enter the abdomen are also oil impregnated.

Inspection then determines the indicated surgery and thus surgery is performed prior to the suspension. At this point the uterus is lifted up and the sigmoid inspected. In these cases I have so frequently found perisigmoidal adhesions that I have come to consider the freeing of the sigmoid a part of the operation (see Figures 5 and 6). As shown in these pictures the sigmoid is frequently found adherent to the round ligament as far as the internal ring. Twice I have found it adherent to the bladder.

The uterus being held upward the base of

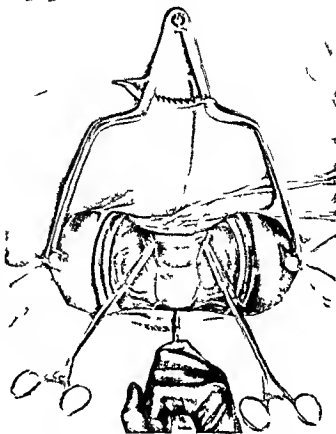


Fig. 11. A suture thread used for demonstration purposes.

the left uterosacral ligament or the one opposite to the operator is picked up by a long French clamp (clamp 1) and a long catgut suture is passed through it (see Figure 9). It is then tied. This is repeated on the right ligament (clamp 2). These sutures are then brought out over the edge of the wound and held by an assistant clamps and having been removed as each suture is placed. These sutures serve two purposes: they hold the uterus out of the way without injury to it and secondly they bring the ligaments well into view (Figure 10). For demonstration purposes a trowel may be used as seen in Figure 11.

The left ligament or the one opposite to the operator is now brought into view and the point of shortening marked by a French clamp (clamp 3 see Figure 11). The other ligament is then exposed and a point on it opposite to clamp 3 is grasped by another French clamp (clamp 4). The operator determines the point of shortening by traction on the ligaments first on one at a time then on both

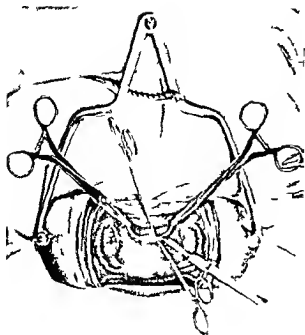


Fig. 1. The Allis clamp is placed on the left broad ligament at its origin (see Figure 1 for their position).

together being careful to allow ample rectal room and at the same time to replace the cervix in its normal position. This may be checked off by putting two fingers in the space between clamps 3 and 4 and the anterior surface of the sacrum with the palmar surface of the fingers toward the uterus. In this way the operator may judge exactly the length of the proposed reconstructed sacral swing.

Two Allis clamps now grasp the ligament at its origin (see Figure 1 for their position). The breadth of the jaw of the clamp is parallel with the ligament, one clamp above and the other below it just at the site of the first catgut suture. Traction on these two clamps will draw the lower segment of the uterus into view and pull upon the base of the ligament. This will enable the operator to take the next step which is to make the button hole. This is made at the base of the ligament by means of a knife and extends along its median line. It should cut the catgut traction suture. This incision should be 1 centimeter long and down to the uterine tissue. It is then extended to 1.5 centimeters along the ligament by placing a blunt pair of scissors in the cut and opening the blades

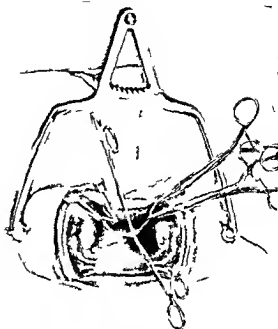


Fig. 2. The Allis clamp is placed on the right broad ligament midway between clamp 3 and the Allis clamps marking the reduplication point (left ligament).

A French clamp (clamp 5) is then placed on the ligament midway between clamp 3 and the Allis clamps marking the reduplication point (Figure 1. A left ligament). Clamp 3 and the Allis clamps are now approximated to see if the sacral end of the reduplicated ligament will reach the button hole without strain.

A medium sized Pagenstecher linen suture is now put in place in the ligament at the site of clamp 3 which is then removed (shown on the right ligament Figure 13).

The needle is then introduced into the button hole and is made to penetrate the uterine tissue to a sufficient depth to give a firm hold (see Figure 1 left ligament) after which the suture is tied. During this procedure clamp 5 is drawn upward and backward and slightly outward as shown in Figure 12. A right ligament. This brings into view the three arms of the ligament: uterine, middle and sacral. A second stitch is then placed through the lips of the button hole at right angles to the incision and as it is introduced first one and then the other Allis clamp is removed. Before tying this second

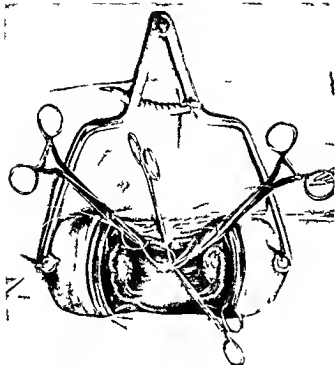


Fig. 13 A medium sized Pagenstecher linen suture is inserted in the ligament at the site of clamp which is now removed

stitch the first one is cut short. This second stitch closes the button hole, buries the first stitch, and completes the implantation of the sacral arm of the reduplicated ligament. This second stitch is left long for traction and marking purposes.

A third stitch is then placed through the three layers or arms of the reduplicated ligament midway in the folded over area, or, if the reduplication is long enough to need it, two stitches may be used. Care must be taken to penetrate all three arms of the reduplication in each stitch to a sufficient depth to hold strongly. A stitch is then introduced at the site of clamp 5 and carried through the sacral arm of the reduplicated ligament in such a manner as will make the joining smooth. All these stitches are left long and attached to clamps outside the abdomen for marking purposes.

The procedure is then repeated on the opposite ligament.

By slight traction on these linen stitches the operator may judge of the completeness of his work and the length of the newly made ligaments. As a further test, two fingers may

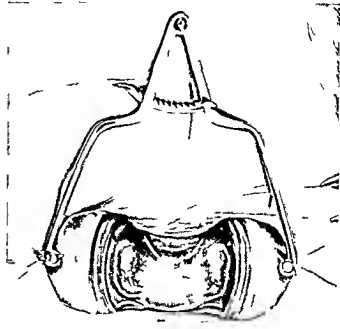


Fig. 14 Completed operation

be placed as at the time of placing clamps 3 and 4.

The linen stitches are then cut short. The knots may be covered by a Lembert stitch involving only the peritoneum. The completed operation is shown in the illustration Figure 14.

If in the opinion of the operator the fundus needs holding downward and forward the round ligaments are shortened either by the Alexander operation or by a modification of the Gilbam operation which leaves no pockets in the peritoneum.

| TOTAL NUMBER OF CASES EXAMINED.....6134 |           |         |        |         |        |            |        |          |        |
|---|-----------|---------|--------|---------|--------|------------|--------|----------|--------|
| TOTAL NUMBER OF SETS POSITIONS.....6036 |           |         |        |         |        |            |        |          |        |
| AGE                                     |           |         |        |         |        | CONTRACTED |        | NORMAL   |        |
| 10-20                                   | 20-30     | 30-40   | 40-50  | 50-60   | 60-70  | 300        | 300    |          |        |
| 116                                     | 1085      | 717     | 275    | 104     |        |            |        |          |        |
| CIVIL STATE                             |           |         |        |         |        | MISC.      |        | INJURIES |        |
| Married                                 | Unmarried | Single  | 1448   | 95      | 20     | 140        | 140    | 140      | 140    |
| 1012                                    | 6557      | 320     |        | 12      | 12     | 107        | 107    | 107      | 107    |
| Gravida                                 | Parity    | Gravida | Parity | Gravida | Parity | Gravida    | Parity | Gravida  | Parity |
| 1448                                    | 777       | 576     | 10     | 1       | 488    | 607        |        |          |        |

Table I Showing frequency occurrence

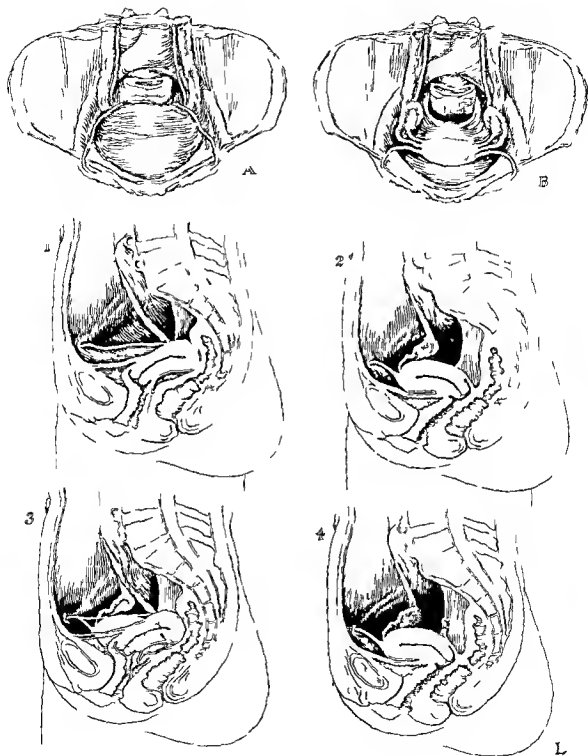


Fig. 5 Diagrams illustrating the surgical approach to the female pelvis.

I have performed 70 sacral suspensions of the uterus and 10 of the cervical stump after hysterectomy a total of 80 with a mortality of one from acute nephritis the other where excessive peritoneal trauma of a previous operation produced insurmountable complications

Where it is necessary to reconstruct extensive birth trauma the operation should be done in two stages separated by one week or more

The labors I have attended after sacral suspension have been most satisfactory. The greatest number of labors in any one case has been four (Mrs. I. operated on November 18 1911 at the New York Polyclinic Hospital). The patient has remained well since without gynecological symptoms. The uterus is now in normal position adnexa negative

My oldest patient operated on at the New York Polyclinic Hospital was 6 years of age

She had complete prolapse a very large right inguinal hernia which was in turn covered by a large ventral hernia. The first operation was tracheloplastic on the cervix muscular interposition perineorrhaphy a condoperation sacral suspension Alexander right uterine herniotomy Blake operation on the ventral hernia

She was well for two years when she returned with an acute traumatic laceration of the perineum cause unknown. The cystocele which persisted was then operated on (September 4 1918 New York Polyclinic Hospital) by the Rawls method and the perineum restored recovery uneventful and complete

As illustrating the value of this procedure in cases in which other forms of operation have failed (of which I have had many) I report Case No. 238

Mrs. C. aged 50 nullipara suffered from most severe dysmenorrhea and menorrhagia all her menstrual life. Appendectomy 1910. She had been twice dilated under ether and a stem pessary put in place and left in six months each time. In October 1911 she had a ventral suspension with a suspension of the left ovary.

I first saw her May 1916 at the age of 18 and suggested a sacral suspension. For the two

years following she was under the best medical advice and the care of specialists with no relief. I saw her again May 23 1918 and advised operation.

Examination showed the uterus firmly adherent to the anterior abdominal wall midway between the symphysis and the umbilicus. As she was growing worse and the pain was relieved only by morphine I urged operation which I did on June 24 1918. The uterus was  $4\frac{1}{2}$  inches long internal measurement. There was a fibrostenotic infected cervix. I performed a tracheloplastic operation a resection of the abdominal scar. A very strong broad band of adhesion which had firmly fixed the uterus was resected from the fundus. A cyst was removed from the right ovary. Sacral suspension performed and round ligaments shortened. Recovery uneventful.

Examination September 12 1918 showed the uterus in normal position adnexa negative. The periods since operation have been profuse only one slightly painful. The patient has regained her health.

On October 17 1916 I operated for the late Dr. White of Hackensack N. J. on a patient three and a half months pregnant for an adherent pathological retroversion. The pregnancy added many difficulties to the operation but the patient made a good recovery and carried the child until the seventh month. The operation was hazardous because she had never carried beyond the fourth month and this was her fifth pregnancy.

It is of the most vital importance in all reconstructive surgery of this type that a true conception of the injury and of the resultant deformity be evolved and that the operation rebuild the traumatized structures and thereby replace the retroverted or posed organs.

My claim for the procedures mapped out is that the trauma is recognized and correctly repaired and that the result is restoration to normal position and function. That the technique described has proved satisfactory in my hands confirms the basic correctness of the procedure.

That there is much to be done in these operative procedures is not the fault of the operation but is inherent in the condition. To do less than all the needed repair is neglect.

## MEGA-DUODENUM

## REPORT OF A CASE IN AN INFANT

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A SEARCH of literature finds no recorded case of giant duodenum in an infant. The symptoms in the case reported began when the child was 3 days old, persisting until the eighth week of its life when it was first seen by me. The condition was diagnosed from the physical and X-ray examinations. Downes of New York reports a case in a child four and one half years old.

The clinical course in the infant is similar to pyloric stenosis in its subjective expression and in its effect in producing rapid emaciation. The differential diagnosis is made by the appearance of bile in the vomitus and in the absence of a palpable pyloric tumor. In the case here reported there was a rapid loss of weight, vomiting occurring at irregular intervals without definite relation to food or fluid intake and after nursing the regurgitated milk returning bile stained and

the subsequent vomitus containing bile and duodenal fluid in larger amounts than fluids ingested. Through the thin and emaciated abdominal walls of the infant as in pyloric stenosis the visible coils of intestines and peristaltic waves were easily observed. Immediately after nursing and before the onset of vomiting the distended stomach and duodenum could be seen in the epigastrium. The roentgenograms demonstrated the abnormal condition with unusual accuracy and clearness of definition.

Normal delivery, fourth child of healthy parent age. Weight at birth 7.5 pounds. She began vomiting yellow fluid the third day. At this time the child was being nursed at two hour intervals. The interval of nursing as lengthened to four hours without effect. Nursing with the head down and body elevated was tried but the vomiting continued. Various medicines were prescribed by the attending physician without benefit.

When first examined by me November 3, 1918, the child weighed 5.5 pounds, showing a loss of 2



Fig 1

Fig 1. Roentgenogram showing stomach filled with food and duodenum also distended.

Fig 2

Fig 2. Stomach small, duodenum also contracted.

Fig 3

Fig 3. The stomach almost empty. Almost no food in the duodenum at the time of the examination.



Fig 4

Fig 4 The stomach is completely empty the duodenum filled



Fig 5

Fig 5 Stomach beginning to refill after retching



Fig 6

Fig 6 Stomach refilled duodenum empty

pounds in two months. She was apathetic, took no notice of people or things, never cried. Her eyes had the Mongolian slant. The tongue was larger than normal and slightly protruding. All of these findings and the facial expression were suggestive

of cretinism. Vomiting occurred at irregular intervals, either bile stained milk or duodenal fluid. She was fed a barium meal with a teaspoon beginning at 11:20 a.m. under such difficulties that it required 45 minutes to feed 2 ounces.



Fig 7

Fig 7 Stomach filled with barium meal. Roentgenogram taken one month later immediately after feeding two ounces.



Fig 8

Fig 8 Roentgenogram taken 15 minutes later showing gastro-enterostomy opening, complete closure of pylorus. There is a small amount of barium meal in the loop proximal to the duodenojejunal junction.



Fig 9

Fig 9 Roentgenogram taken 15 minutes later showing the stomach rapidly emptying through the gastro-enterostomy opening, complete closure of pylorus. There is a small amount of barium meal in the loop proximal to the duodenojejunal junction.





of duodenojejunostomy is equally applicable here or whether the operation of the long loop posterior gastro enterostomy as done by me with the occlusion of the pylorus or the no loop gastro enterostomy as done by Downes in the only other case reported is a question largely to be determined by the pathology observed during the course of operation. It does appear in this case that there was some abnormality at the duodenojejunal junction. When done in infancy and early childhood it appears that the posterior gastro enterostomy with occlusion of the pylorus is sufficient and that the end result of such operation is obtained in the two cases reported would warrant its performance.

The possibility of this being a congenital abnormality or defect would be supported in a measure by the suspicion of cretinism in this infant. At the same time it is entirely possible that such a giant duodenum could develop within 8 weeks after birth as a result of partial obstruction at the duodenojejunal junction of congenital origin.

Gastro enterostomy with pyloric occlusion is the operation of choice in partial obstruction at the duodenojejunal flexure in infants for the following reasons:

#### CONCLUSIONS

1 The dilated stomach is drained into jejunum.

Pyloric occlusion diverts bile and pancreatic fluid into jejunum and prevents regurgitation into stomach.

3 Bile pancreatic and duodenal fluids with the contained hormones so greatly needed are more largely conserved than if pylorus were not occluded.

4 Regurgitation into stomach and loss of fluids is lessened through cessation of vomiting—more certainly obtained in gastro enterostomy with pyloric occlusion than in duodenojejunostomy.

5 Pyloric occlusion is essential.

6 Five months have elapsed since this operation was done and the infant weighs 12 pounds 8 ounces April 19 1919.

## AN EXPERIMENTAL STUDY OF THE USE OF DETACHED OMENTAL GRAFTS IN INTESTINAL SURGERY

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A C C E P T E D F O R P U B L I C A T I O N M A Y 1 9 1 9

At the present time when every effort is being made to facilitate operations within the abdomen it seems especially important that a clear understanding of the possibilities of the omental graft should be obtained.

The functions of the great omentum are still the subject of considerable speculation. Rubin from a pathological and experimental study came to the following conclusions:

The omentum has no spontaneous motility, no demonstrable chemotaxis, no intelligent or spontaneous protective role, no ability to restore vitality or vascular supply to other organs; it does not always close defects; its usefulness depends on its power to form ad-

hesions to absorb toxic products and to destroy foreign substances through its phagocytic agents; it acts as any mesentery giving fixation to certain viscera and carrying their blood supply; its protective properties are due to the peritoneal layers detached; omentum becomes necrotic and is useless.

The use of omental grafts, both attached and detached, has been advocated spasmodically for several years. The literature on the subject is however very limited. For a number of years many surgeons have made use of the omentum to cover abraded peritoneal surfaces and to reinforce the suture line after closure of gastric and intestinal perforations. The reported cases are how-



Fig. 1. The method of implantation of the omental graft. The omentum is attached to the stump of the intestine by a suture line.

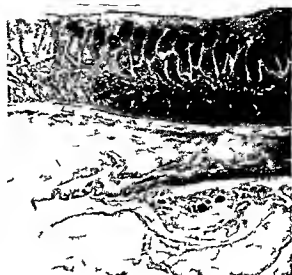


Fig. 2. The method of implantation of the omental graft. The omentum is attached to the stump of the intestine by a suture line.

ever largely clinical and the ultimate fate of the grafts is unknown.

Binne recommends reinforcing the suture line with free omentum to prevent intra-abdominal hernia. He also suggests the use of omental grafts to cover the stump of fatty me enteric after the removal of large amounts of small intestine. In a case of duodenal perforation in which the opening could not be closed by suture Clogg successfully covered it by attached omentum. Binne points out that a free graft would be preferable as the former might be the excuse for an internal hernia.

Warbasse recommends the use of both attached and detached omental grafts to strengthen intestinal suture lines. Fowler offers a similar suggestion and refers to the experimental work of the elder Senn who recommended scarification of the intestinal wall before application of the graft.

The value of the great omentum especially in constructive surgery is pointed out by Charles Mayo and the need of its conservation emphasized. He recommends its use to prevent or make harmless visceral adhesions to cover denuded surfaces to prevent union of stomach or duodenum with the liver after cholecystectomy by interposition and suture

of omentum to round ligament to cover damaged intestine to reinforce suture lines and carcinomatous areas which are in danger of perforation from distention. He states that free grafting of the omentum is a temporary patch which soon necroses and becomes absorbed after serving its purpose.

During the course of experiments to control postoperative adhesions Sweet Chaney and Wilson applied free omental and free mesenteric grafts to the intestinal suture line in two animals. The autopsy one and two weeks after operation showed the grafts in place and free from adhesions.

The use of mesenteric grafts should not offer any greater difficulties than the use of omentum and in all probability would be found equally beneficial since it has two peritoneal layers. However it should not be especially fat as the chances for necrosis would be greater. The use of mesenteric grafts would be light since it is practically never available except after resection of the small intestine.

Two noteworthy papers on the subject of detached omental grafts have appeared. The first by Freeman is purely a discussion of the clinical use of omental grafts with mention of certain cases in which the author has made

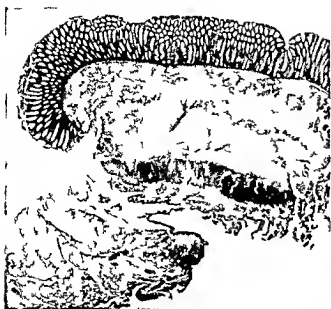


Fig 3 Free omental graft sutured over puncture in intestine Three months after operation No closure of opening other than with graft Some infiltration and destruction of graft due to infection of its inner layer by intestinal contents Graft however survived and permanently closed opening

use of this procedure There are no pathological reports and the evidence as to the advantages gained is apparently derived solely from the postoperative history of the patients Freeman recommends from his clinical experience the use of free omental grafts to replace lost portions of peritoneum to prevent adhesions to strengthen suture lines in operations upon the stomach and intestine to occlude the pylorus or intestine and to check hemorrhage from raw surfaces especially of the liver spleen and pancreas He states that the technique of omental grafting is simple although certain precautions must be observed In brief these are The pedicle should not be puckered by the ligation The free border of the omentum should be chosen with avoidance of large vessels As little tissue should be sacrificed as possible The graft should be sutured in place The transplant must extend beyond the raw surface

The article by Davis is devoted largely to experimental work He transplanted free omental grafts to the stomach intestine liver spleen kidney and bladder to denuded areas of the parietal peritoneum and beneath the skin Davis also used it to check hemor-

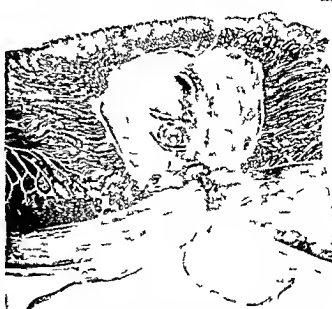


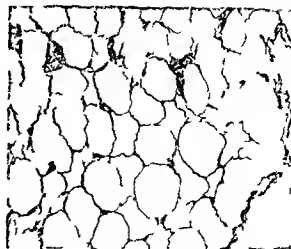
Fig 4 Three months after suturing free omental graft over end to end anastomosis Silk suture still in place in intestine Graft has survived practically unchanged No adhesions

rhage in the liver spleen and kidney Two microphotographs show the omental grafts in the spleen and liver He states that the results in these experiments were excellent the omentum surviving to a surprising degree and when used as a hemostatic the hemorrhage ceased almost immediately Grafts up to three inches in diameter were successful

The work of Davis substantiates the contention of Freeman that free omental grafts survive at least under sterile conditions and that the omentum is a serviceable hemostatic agent

There are numerous questions however which have not been satisfactorily answered and we therefore present the evidence from our own experiments

The object of the experimental work was to determine first what became of free omental grafts when placed on the intestine under sterile and under septic conditions Second the size thickness and vascular condition of the graft which would insure the best vitality Third the preferable method of its application to the intestinal wall to insure its vitality and prevent its displacement Fourth a method to prevent adhesions from adjacent intestines and omentum to the free graft Fifth in what surgical conditions



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would the use of free omental grafts be justifiably useful or necessary.

The experiment was commenced in February 1916 in the Department of Experimental Surgery, University of Pennsylvania and completed at the University of Michigan. Dogs were used exclusively and all operations were performed under ether anesthesia and strict sterile precautions.

#### EXPERIMENTS

##### SERIES I

1. To determine the fate of detached omentum and the proper size and thickness to obtain the best results when placed on uninjured intestine (aseptic conditions). Detached pieces of omentum were sutured to uninjured intestine under strict aseptic conditions and the animal killed by ether at periods varying from two weeks to six months. The size of the graft was carefully noted at time of operation and pieces of omentum of various sizes and thicknesses were chosen.

b. To determine if the vascular condition of the graft influenced its utility. Exactly similar procedures were carried out with the single exception that the omental tag was doubly ligated before separation from the

large omental sheet, the section being made between the ligatures, thus leaving the vessel of the graft filled with blood.

c. To determine whether abrasion of the peritoneum was a factor in the survival of the graft. Experiments similar to a and b were performed except that the peritoneal coat on the intestine was abraded. This was done by rubbing with dry gauze by multiple fine puncture and by scarification with the scalpel.

d. To determine the best method for attaching the grafts. Omental grafts were sutured to the intestine with finesilks with plain iodine and chromic catgut. The grafts were also sutured to the mesentery on each side of the gut around which the graft was placed.

##### SERIES II

a. To determine the fate of detached omental grafts under possible septic conditions. The intestine was punctured and the wound closed with Lambert sutures. A detached sheet of omentum was then spread over the suture line and fastened in place. Lateral and end to end anastomosis was also made and the suture line covered with omentum.

b. To determine the ability of the graft to prevent the spread of infection. Punctures of the intestine and end to end anastomosis were

made with a simple approximating suture and the sutures reinforced with free omental grafts. Small punctures were also covered with grafts without any attempt to close the wound with suture.

#### SERIES III

*To determine a method of preventing adhesions to the graft*

In all the experiments the cut edges of the graft were carefully turned under but some adhesions still persisted frequently to the free edge of the great omentum. In this series the grafts were either coated with vaseline with paraffin oil or were washed carefully with warm saline after being sutured to the intestine. The omentum was also carefully folded back and away from the grafts and in a few cases the greater portion of omentum was removed.

#### SERIES IV

*To determine what structures are suitable for the application of omental grafts* Free omental sheets were applied after opening and suturing to the stomach all portions of the intestine the liver the spleen and the parietal peritoneum.

The microscopic sections were prepared by Dr. Lynne Hoag the microphotographs by Dr. Frederick G. Novy.

#### RESULTS OF EXPERIMENTAL WORK

It was found that detached omentum survived in practically a normal condition when applied under sterile conditions to any abdominal organ. The size of the graft made no difference in its vitality. The thickness however is important. The thinnest grafts survived best and were least liable to favor adhesions. Thick grafts especially those containing a large amount of fat were frequently the source of large adhesions and on microscopic examination round cell infiltration and loss of fat were noticeable. No difference could be determined between the grafts which were doubly ligated before attachment and those in which the blood escaped from the cut vessels.

Mechanical irritation of the peritoneal layer on which the graft is placed is not necessary.

The vitality of the piece of omentum was equally good when the graft was placed on uninjured surfaces as when the area was rubbed, punctured or scarified. Hemorrhage under the graft however seriously impaired its chances of survival and seemed to favor the formation of adhesions.

Plain fine silk was found to be the preferable suture material. Practically no reaction was noted about the silk. This material can be tied in a very small knot and the ends cut close without danger of the knot untying. Plain catgut, size 00 is very good but acts to a certain extent as an irritant. Iodine and chromic catgut are decidedly irritating and favor dense adhesions. At all times an attempt was made to turn in all raw edges and to have the knot covered by the edge of the omentum.

Sutures must be placed at least at the four corners of the graft to prevent rolling. Suturing to the mesentery on each side of the intestine offers no advantages. In several instances it seemed a disadvantage as the mesenteric attachment was the only seat of adhesions to the great omentum or the neighboring mesentery. It is not necessary to place numerous sutures just enough to hold the graft in place is far preferable.

Detached omental grafts survived in every instance when used to reinforce Lembert suture lines when infection was kept at its minimum. When used to close small punctures and the cut edges of an anastomosis after a simple approximating suture the graft succeeded in preventing the spread of infection to the general peritoneal cavity. It did so however more as a mechanical patch than as a living tissue since the graft always showed marked pathological changes. The fat was largely lost and the whole mass densely infiltrated. It also was the seat of dense adhesions. The graft was undoubtedly of benefit since a general peritonitis was prevented but its action was only temporary and was supplemented rapidly by adhesions to the great omentum or adjacent intestine.

No method was found certain in preventing adhesions. The use of vaseline or paraffin oil increases their number and density. Washing in saline had no apparent effect.



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## THE FUTILITY OF BRIDGING NERVE DEFECTS BY MEANS OF NERVE FLAPS

BY BYRON STOOKLY A M M D

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The repair of nerve defects by means of nerve flaps has long been in use having been described by Letevariant in 1872 and first attempted in human surgery as was reported as a failure. The other cases have hardly been more encouraging. Most surgeons considered that reason had long since demonstrated its futility and had been definitely settled. However lately reference again has been made to this procedure as a valuable one in nerve surgery. In fact recently it has been warmly advocated by Mackenzie for the repair of nerve injuries in this war. It is regrettable that the wounded have been deprived of its benefits and of their fate. In order that this attempt to bridge nerve defects may finally be justified or its real futility determined, this attempt is made to present the technical and experimental evidence as far as I am aware the cases of bridging nerve defects by means of nerve flaps, central or both, have never been collected in the literature there are several thorough reviews of nerve suture without however a review. Especially to be mentioned are those of Woelfer Huber Spijarny and recently Coste. Spijarny assembled the literature in all 19 cases and to those from the Moscow clinic Powers in his review quotes Spijarny as presenting 11 cases of nerve flap operation which was not able to verify. After caring over all cases recorded by Spijarny there were to be found. They are those of

Letevariant Tillmanns Dittel Brenner and Gleiss numbered respectively according to his table number 16 104 184 185 188. Gleiss case though a nerve flap was also tubulized and hence was placed by Spijarny under the category of tubulization.

To this list must be added the case of Bobrov presented for the first time by Spijarny. In all 6 cases of nerve flap are mentioned in Spijarny's article.

Powers error may have originated from the review of Spijarny's paper which appeared in the *Revue de Chirurgie* in which the statement is made that the flap method of Letevariant was performed eleven times.

In Powers article there are references to 11 cases of nerve flap operations but with no attempt to give any definite data concerning them. One case that of Neugebauer though classified as a nerve flap operation is not one. This error is probably due to the conflicting meaning the term neuroplasty has come to have. Neugebauer so designated the case though neither central nor peripheral flaps were used. Gleiss case is also recorded as a successful flap operation in spite of Gleiss statement that the case showed no evidences of regeneration.

To make this report more complete it was thought best to review in the original reports the cases found in the literature from the first operation of Letevariant up to and including the year 1914. Sufficient time has not elapsed for those cases operated upon since 1914 to admit final judgment with justice.



to the method. Furthermore since the war all of our former literature is no longer available. Hence for these reasons the cases have been investigated only up to 1915.

I am aware that some few surgeons during the war when it was felt that something must be done to overcome the large nerve defects frequently found have attempted this operation in quite a series of cases. Gratzl performed flap operations in 8 cases on the German wounded. The distance bridged varied from 3 to 8 centimeters the average being 4.6 centimeters. The average time between operation and publication of the report was five months—a period obviously too short to admit of any valuable deduction. Gratzl himself says: "The results after so short a time are not yet definite. These cases and others like them will have to be investigated later when final end results are available."

It is unfortunate that some cases in the original reports could not be obtained. Some omission of cases which should be included however regrettable would not be surprising in view of the difficulty in collecting them. An earnest attempt has been made nevertheless the list may not be complete.

It was at first planned to present them in tabular form but this was deemed inadvisable in view of the great variation in the cases and the necessity of presenting more details than could be given within the limits of a table. Furthermore it was felt that a brief resume of each case together with a critical review rather than a simple collection of the nerve flap operations might be of greater service and enable more valuable deductions to be drawn. Thus the cases in place of being merely assembled have been submitted to a critical study in accordance so far as their reports permitted with the more recent advances in nerve surgery. By so doing it was felt that a more positive position might be taken in regard to bridging nerve defects by means of nerve flaps particularly if to the clinical data were added the results of experimental evidence.

In the literature it is very evident that there is considerable confusion of terms not only in our own language but also in French, Italian and German.

The term neuroplasty has been used to designate operations by the method of anastomosis by crossing as well as by nerve flaps. In the German literature neuroplasty is also occasionally referred to as the Heuter-Zerny method neither of which authors originated the nerve flap method. Since the term neuroplasty does not in itself designate any particular type of operation it would therefore seem best to drop the word altogether and to indicate each operation by its own specific term viz nerve flap etc.

Sherren pointed out the lack of uniformity of terms in English when compared with those in use by continental writers. He suggested that the word graft be altogether dropped since on the continent it is used in a totally different sense. However appropriate when Sherrens suggestion was offered twelve years ago at this time it might not seem advisable to omit this word so long in usage for other tissues. It designates to our minds a definite type of operation and is now universally so used by the continental writers. Durou, Babinski, Dejerine, Nageotte and Gosset etc. All of these speak of the *greffe nerveuse* to indicate a segment of nerve interposed between the severed nerve ends of a nerve trunk and no longer only for nerve implantation as was formerly the case.

The term graft is in conformity with long surgical usage to designate the removal of any tissue from one site to another.

In order that there may be greater conformity and perhaps less confusion I would venture to suggest that the term neuroplasty be totally omitted the term nerve graft as well as transplant be used to designate interposition of a nerve segment between the severed nerve ends of a nerve trunk. The graft naturally being further designated as autogenous, homogenous or heterogenous and also whether living or dead, fresh or preserved (cold storage etc.). The rather recent extensive usage of the word transplant has given to it perhaps a more definite place than graft and among most writers it will be given preference.

Sherrens suggestion concerning further uniformity in nomenclature should be some what modified and more generally adopted.

Sherren has suggested that the term nerve anastomosis be used to designate the operation of nerve implantation *greffe nerveuse* according to the method of Leticiant and the German *Nervenpfropfung*. He also includes under anastomosis the operation whereby a flap is raised from the sound nerve and sutured to the distal end of a severed nerve. From an anatomical standpoint this last operation is quite a different procedure. In this the severed end of the injured nerve is brought in direct apposition with the severed and cut end of the nerve flap in which there are severed neuraxes. Whereas in the former operation of implantation either central peripheral or both the severed ends of the injured nerve are implanted in a slit made in the sound nerve. Most often the slit serves only to separate the funiculi and does not cut the neuraxes except incidentally. The severed nerve ends come to lie between funiculi and not in the main against severed neuraxes as is the case when a flap is raised from a sound nerve and is sutured to the distal end of the injured nerve. Thus from the standpoint of nerve regeneration the term nerve anastomosis as suggested by Sherren would come to include two distinct surgical procedures.

It might tend toward a more definite conception of nerve repair were the operation above described that is to say the raising of a flap from a sound adjacent nerve and the end to end suture of it to a severed nerve be included in the division of nerve crossing.

Nerve crossing seems to me to be the most descriptive term in use. By it is meant the union end to end of the central end of one nerve with the distal end of another. This would be *complete* nerve crossing. When a flap is raised from a sound nerve and sutured to the end of another the operation should be designated as *partial* or *incomplete* crossing. Both procedures have the same anatomical basis and should be included in the same division.

It might then seem advisable since this operation is removed from the category of anastomosis and placed in the division of nerve crossing that in place of the term nerve anastomosis as suggested by Sherren the

term nerve implantation be again used to designate the implantation into a sound nerve of either the central peripheral or both ends of an injured nerve.

In resume then the terms suggested are nerve graft or nerve transplant preferably the latter to designate the interposition of a nerve segment between the severed ends of a nerve nerve implantation to designate the insertion of a nerve end central, peripheral or both into a slit made into a sound nerve nerve crossing complete or partial to designate the end to end union of a severed central end of one nerve to the peripheral end of another or the end to end union of the end of an injured nerve to a flap raised from the central portion of a sound nerve. The operation of nerve flap should be called nerve flap and not neuroplasty which term is too vague and general.

Perhaps no one case in the literature of nerve flap suture has been more extensively advocated in support of a continuation if not a revival of the nerve flap operation than the case of Mackenzie. Frequent references and quotations of it are to be found here as well as abroad. Binnie cites in his *Operative Surgery* the case not merely but the accompanying figures as well and thereby has lent in a measure support to this procedure which it was thought had been shown to be of little value if not harmful. For these reasons among others the case merits a more thorough study to determine if possible what actually has been the end results and what Mackenzie's reports have contributed to the advance of nerve surgery or if they have served to bring about a renewal of a method which should have remained definitely in the category of discarded surgical procedures.

Mackenzie in his last report makes an earnest plea for the use of this method. He says "It is inconceivable that any other method could have brought about equivalent results."

Studied from a critical standpoint there are certain facts in the papers of Mackenzie which should be examined more thoroughly before judgment is passed. If this case as reported will stand investigation then the nerve flap method is revived not only but

the whole question of peripheral regeneration which has long since been shown to have been *hors de combat*

Mackenzie after removal of 10 75 inches of the sciatic *in toto* from the lower border of the gluteus maximus to 1 inch above the apex of the popliteal space with every effort to preserve any visible branches performed two successive flap operations the first 16 days after the original operation A flap 16 75 inches in length with its diameter a shade less than half the diameter of the internal popliteal beginning at the level of the lower border of the internal malleolus to within a half inch of the divided end of the internal popliteal Its end was then implanted in a *slit* made in the tump of the sciatic nerve By a similar method a second flap was made of the same length from the external popliteal

Mackenzie reports that following the operation for removal of the tumor mass there was absolute paralysis of the leg It is presumed that the author does not include the thigh since there could have been no paralysis of the extensor quadratus etc No mention is made at this time of the state of the important muscles namely the biceps semitendinosus semimembranosus etc

Following the removal of the cast after the first flap operation about the tenth day the leg could be very feebly flexed Since this movement of flexion of the leg upon the thigh occurred 10 days after the operation manifestly a time too early for any possible regeneration it is but possible to conclude that the complete nerve supply to the flexors of the leg was not severed It is well known that the nerve branches to the biceps and semitendinosus come off exceedingly high up in the thigh in fact not in the thigh at all but in the gluteal region higher than the line of excision of the tumor as given by Mackenzie viz at the lower border of the gluteus maximus

According to Pierol there are two sets of branches to these muscles an upper set leaves the sciatic below the tuber ischi and ends fibers to the upper portion of the semitendinosus and lower head of the biceps femoris It is thus improbable in view of

the line of excision that this supply to the flexors of the leg was severed Mackenzie in the operative report makes no mention of having cut these branches indeed every effort was made to preserve any visible branches It would be of value to know what branches in the thigh were saved

It is only after making his clinical observation that it is stated that the branches to the flexors of leg were divided It is entirely probable judging from the anatomical position of the operation that the lower and not the upper branches were severed In this manner the voluntary power of feeble flexion of the leg ten days or thereabouts after operation can readily be accounted for by the remaining nerve supply to the semitendinosus unsevered and to all probability not even within the operative field Hence the fact that the patient is able to flex the leg upon the thigh cannot be offered later on following the nerve flap operations as evidence of nerve regeneration and restitution of function At no time probably was there total loss of the power of flexion of these muscles Again shortly after the second flap operation (no definite time is stated) it was manifest now that the leg could be bent on the thigh with most freedom and energy but it was noticed that there was very little muscular power in the movement

It has been a clinical observation by Jones Stookey Tinel and others in not one but many cases of sciatic injury that the hamstring escape injury at least sufficiently to permit of some flexion of the leg on the thigh due no doubt to the double supply of these muscles the higher branches coming off before the nerve emerges into the thigh from under the gluteus maximus Spizary commenting on a similar case operated upon by Bobrov in which 12 centimeters of the sciatic was removed says On the twelfth day when the extremity was straightened the movements at the knee were performed almost freely—the flexors contracted well In this case he says It is necessary to note the rather quick recovery and the appearance of function of the flexors of the leg namely biceps semitendinosus and semimembranosus This is another example of

extensive operation on the sciatic with retention of the upper group of branches to the hamstring and with power of contraction remaining in these muscles. Thus with retention of part of the nerve supply to the hamstrings the patients soon become accustomed to the paralysis of the lower leg and are able to walk and even run with but little inconvenience other than foot drop. Therefore to attribute as has Mackenzie independent and unaided locomotion as proof that regeneration has taken place is fallacious.

In order to determine in greater detail than is usually given on this point of some clinical importance an investigation was made on eight sciatic nerves.<sup>1</sup> After exposing the gluteus maximus its lower border was determined. At this level over the sciatic nerve a heavy blunt dissector was inserted through the tissues marking the lower border of the muscle. The sciatic was then exposed from above downward in order to avoid stripping up the nerve branches. The point at which the upper group left the nerve to the hamstrings was then determined. In every instance it came off from the nerve at about the level of (in one instance 1 centimeter below) the tuberosity of the ischium and above the lower border of the gluteus maximus. In one instance it came off 6 centimeters above this level and in another 2 centimeters—the average being 3.5 centimeters above the gluteus maximus. The nerve is not really a branch of the sciatic but a separate nerve—the nerve to the hamstrings which is described by Piersol not under the heading of the sciatic nerve and its branches but under the muscular branches of the sacral plexus. The nerve lies in loose connection with the sciatic and may be readily separated from it for a considerable distance. This anatomical consideration may explain the frequency with which the semitendinosus escapes injury. Another point may be deducted namely that in operations in which the sciatic must be severed even up to the sciatic notch this nerve at least its upper branches may be saved and flexion of the leg rendered possible.

Thus the evidence in Mackenzie's case in support of regeneration following the nerve flap operation enabling the hamstrings to contract together with the appearance of independent and unaided locomotion is not beyond criticism and most certainly cannot be accepted as conclusive evidence in support of the nerve flap operation.

The remaining muscles to be investigated are the flexors and extensors of the foot concerning the paralysis of which there can be no doubt. Should these muscles show a return of function enabling the movements of the foot to be accomplished then the value of the nerve flap method in this case might be firmly established or conversely its futility determined.

In his first report there was complete reaction of degeneration of these groups six months after the last operation. Mackenzie reports at this time partial reaction of degeneration of the extensors of the foot and complete reaction of degeneration of the flexors of the foot. In the paper of October 1918 more than ten years after the operation Mackenzie states minute examination of these muscles show them to be strong and capable of contracting and while they do not move the foot they control it and there is but little tendency to foot drop. Some of the muscles of the group now show only partial reaction of degeneration. It is regrettable that no mention is made of the examination of particular muscles.

However let us see what progress during these years this represents as compared with the examination made six months after operation. In the first report it is said that while these muscles do not move the foot they control it and there is no tendency to foot drop. Comparing these two reports there seems to be little discernible difference mostly in favor of the report 10 years ago in which it is said there is no tendency to foot drop whereas the last report shows but *little* tendency to foot drop.

Physiologically it is inconceivable that muscles should be able to control the foot without having the power of contraction and without (in the absence of ankylosis etc.) being able to move it. Professor Bobrov

<sup>1</sup> Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918. The following are the names of the patients: 1. Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918. 2. Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918. 3. Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918. 4. Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918. 5. Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918. 6. Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918. 7. Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918. 8. Whittham, K. D. M. C. U. S. Army, Surgeon General, U. S. Army Medical Department, Washington, D. C. 1918.

commenting upon his case so very similar in all its aspects recognize that because of the degeneration of muscles into connective tissue a more or less desired degree of diminished foot drop is obtained. His patient was able to walk totally satisfactorily ever since the operation the patient never caught the toe of his boot on the floor and did not experience any special inconvenience from his paralyzed foot. However Bobrov did not attempt to attribute these results to any reestablishment of conductivity by means of the nerve flap operation but says that it follows that the removal of the sciatic nerve for a great distance even though *one does not succeed* in restoring nerve conductivity by a plastic operation does not necessitate the removal of the extremity.

From Mackenzie's own reports both 14 months and more than 10 years after the operation these muscles are unable to move the foot yet Mackenzie states they control it. If for so long a time after these two nerve flap operations there has been no return of flexion or extension of the foot there is little or no evidence of motor recovery.

In resume on the motor side there are no acceptable evidences judging by both reports of Mackenzie of return of motor function of muscles unquestionably demonstrated paralyzed at the time of operation. The evidence in favor of this operation from the view of motor recovery is neither conclusive nor acceptable.

The sensory findings perhaps admit of less definite and final criticism since unfortunately there is considerable variability in the method and manner of determining the limits of loss of the various forms of sensation. The personal equation may play a very important role. Anyone who has gone over carefully a number of nerve injuries will be aware of the many possible pitfalls and source of error.

Mackenzie states that there is recovery in a limited degree of protopathic and epicritic sensibility and that there is *almost* universal recovery of deep sensibility. The chart accompanying Mackenzie's last article shows the loss of sensation if not identical very similar in its boundaries to the chart ten

years previous. It is a well known fact that deep sensibility in total sciatic injuries is frequently not almost absent is very limited. So constant was this variability in these cases that latterly I discarded it as evidence of comparatively little value. Mackenzie at his original examination states that even within the area of presumed loss of deep sensation there seems to be a remnant of response to the stimuli of deep pressure. However epicritic and protopathic sensibility i.e. the sensation to cotton wool compass points and moderate degrees pin prick and extreme degrees are of immense value.

The progressive shrinkage of their borders are of the utmost diagnostic and prognostic importance. Their return is apace and often in advance of any motor return. That their loss in this case more than 10 years after the operation should be recovered in a limited degree is in keeping and harmony with the lack of motor return. In the original report years ago Mackenzie states there is almost universal recovery of deep sensation extensive development of protopathic sensibility and much recovery of epicritic sensibility. In the 1918 report as stated above there is recovery only in a *limited degree* of protopathic and epicritic sensibility.

It would appear then that there is little change in the sensory status within the past 10 years.

Surely neither the motor nor the sensory evidence as reported by Mackenzie warrants the conclusion of progressive regeneration on a colossal scale.

Further evidence in support of the nerve flap operation is offered by Mackenzie which if acceptable revives the whole theory of peripheral regeneration and immediate return of nerve conductivity by primary union. Immediately following the union of two nerve flaps there is established according to Mackenzie the transmission of a force which governs nutrition and greatly arrests trophic shock. The effect is almost immediate and very striking. They (nerve flap operations) also demonstrate that muscular tone follows promptly upon the splicing of a divided

nerve Mackenzie states that bridging this large gap with a flap would do good by *establishing conductivity* and again implantation in the gap of a large nerve element to *establish a nerve path* and foundation for regeneration and that it tends to show that regeneration takes place from the peripheral as well as from the central end of a divided nerve though more recent studies would *tend to confirm the principle* of regeneration from the central end. In no other way than by *immediate return* of conductivity could these phenomena reported by Mackenzie be accounted for.

On the tenth day after the first flap operation Mackenzie reports that on removal of the cast the evidence of trophic disturbances were largely swept away. Within two weeks after the second operation there was revealed marked improvement in the nutrition of the leg and all trophic disturbances seem to have cleared away except over the central part of the anesthetic zone. Thus these changes occurred almost at once after the nerve flap operation. Ten years later trophic recovery is practically complete essentially the same remark as in his earliest report. In this respect as well as on the motor and sensory side the intervening years seem to have revealed very little if any progress.

Placing a limb at rest in a cast thus maintaining it immobilized and protecting it from trauma so potent a factor in the production of so called trophic ulcers and blebs etc. will as is well known greatly improve its condition and appearance. This improved condition may be further increased by massage and electricity which were given this patient. Under such treatment in complete nerve injuries even before operation I have repeatedly seen most marked improvement in the appearance of an extremity. To attribute these changes to an immediate establishment of nerve conductivity is obviously erroneous.

In Mackenzie's second case also an excision of the sciatic nerve two flaps from the central portion were made. About 8 inches were removed on account of scar tissue. Several operations had been performed due to the unfavorable conditions which had pre-

valued and over which Mackenzie had had no control. The wound previously had been seriously infected and the amount of scar was excessive. In order to obviate this Mackenzie imbedded the nerve flaps in the adjacent muscles forming a groove for them by means of a blunt dissector.

The report of this case was made two years after the last operation. One might perhaps by this time anticipate a certain degree of beginning regeneration. On the contrary there has been no recovery of motion in the muscles supplied by the internal and external popliteal nerves and the foot is still vulnerable in places. Notwithstanding these facts which indicate essentially no return of function Mackenzie reports that it is perfectly clear that extensive regenerative changes have taken place in the leg and that they are still progressive.

The only apparent improvement is that the patient can perform locomotion over a distance of 4 or 5 miles without adventitious aid and that there is excellent control of the foot and leg on locomotion permitting only a very slight tendency to foot drop. The rather obvious deduction from such *apparent* power of locomotion is that there has been some return of motor contraction of the paralyzed muscles. This however has been not the case according to Mackenzie who states as above quoted that there had been no return. The same criticism holds here as in the first case namely that *total* movements which may be taken on by other muscles or which the patient can in a measure dispense with cannot be offered as *alid* evidence of nerve regeneration.

Certain technical points are raised in this case which are worthy of attention. The passage through muscle of nerve tissue especially when it is stripped or cut from the nerve trunk, i. e. having torn and rough edges tends to increase the amount of scar tissue formed and may thereby endanger the downgrowth of neuraxes were these to reach the flaps. Placing nerve flaps or grafts in the smooth fascial planes *between* muscles is an excellent procedure. *Surrounding* them with torn and naturally bleeding muscle fibers as is done when a flap is pulled through

a tunnel in a muscle made by blunt dissection is to be avoided

The conditions found in this case as to excessive scar formation are precisely the problems which present themselves in nearly all war wounds. And what in this appeared to Mackenzie as grave and almost insuperable difficulties to the success of the nerve flap operation are precisely the difficulties with which it would be necessary to deal in war wounds.

In Mackenzie's third case a flap of 15 inches was turned down from the central stump of the musculospiral nerve. The operation was done in the presence of some infection apparently not any more than requiring a drain for 4 hours when it was removed and the wound healed quickly thereafter. The patient regaining in 8 months control of her hand.

Here again in the end results a total movement is offered as evidence of recovery. The author reports eight months afterwards that the hand could be lifted from the wrist into its correct position and that within fifteen months this young woman was taking the massage course at McGill.

The status of the individual muscles involved is not stated. Such data while satisfactory as criteria in many other surgical conditions can not be accepted as scientific evidence in nerve injuries and form a basis of recommendation for a given procedure in nerve surgery. The question is not can the patient walk or move the hand but do certain muscles which were demonstrated paralyzed again function? It is well known since Lettievant that many movements may be successfully imitated and although the movement is accomplished the paralyzed muscles may have played no role.

It is neither the movements nor the utility of the hand which should be investigated but the muscles. A principle which formed the fundamental basis of Lettievant's teachings.

For example complete supination may be simulated in total musculospiral paralysis by the action of the external rotators of the arm when the arm is moved as one piece. As pointed out elsewhere in median paralysis the patient may be able to flex the fingers with the hand in supination by quick extension of

the wrist followed by sudden relaxation. Flexion of the wrist may also be accomplished by associated action of the extensors which may lead if a careful examination is not made to erroneous conception of the muscles paralyzed. Even the finer movements of the muscles of the hand may be so well performed that considerable care is required to appreciate the difference. The action of the opponens pollicis may be so deftly imitated by the flexors of the thumb and adductors that one can with difficulty distinguish the difference as Beevor, Claude Duma and Forack pointed out that the thumb in an attempt to touch the fifth finger skirts the base of the fingers and does not openly cross the palm but yet is able to reach the little finger—a movement very similar to true opponens action. If during the movement one feels at the base of the thumb absence of contraction of the opponens muscle will be noted.

In ulnar paralysis adduction of the thumb that is movement of the thumb toward the index in a plane at right angles to the palm cannot be performed. But if you place your finger between the thumb and index the patient will be able to squeeze it quite tightly in an action resembling very closely that of pure adduction but accomplished by either the long extensor of the thumb or the long flexor. If in the effort the movement is accomplished by the extensor extension of the whole thumb takes place and there is outward rotation. If by the long flexor the distal phalanx is flexed and the surface of the thumb looks toward the palm. Thus many movements apparently under the control of a given nerve may still be accomplished even though the nerve is totally severed. I have frequently seen in nerve injuries such total movements performed in a most surprising manner even writing and using a knife and fork etc. movements which require a certain degree of finesse.

From this and other cases to follow it is obvious that there is great need for correct appreciation of the proper criteria and accurate evidences of beginning regeneration, progressive regeneration and completed regeneration. No case should be presented in

support of the successful employment of any given surgical procedure unless it falls into one of the above categories and is accompanied by the corresponding data essential to admit of determining the degree of regeneration. Were cases reported so divided and presented then the evidence offered would readily permit correct and valuable deductions.

It is well appreciated that in order to report end results a period of years may be necessary. Hence the above classification would give an opportunity to offer from time to time various methods. In view of the rather experimental stage nerve surgery is recognized to be in at the present time beginning and progressive signs of regeneration are perhaps of great value. End results are obviously to be preferred. Charts and the electrical examination of each muscle or muscle group both before operation and during the period following the operation as well as individual muscular action rather than total movements should accompany the report of each case. It is distressing to investigate the published histories of so many cases only to find that the reports as stated are of little value since the accompanying data are deficient.

*Technical considerations. Central flap.* By splitting or cutting a flap from the central portion of the nerve a definite part of the down coursing neuraxes are permanently destroyed, the number in proportion to the width of the flap. It has been argued by Stoffel that each funiculus has a definite course within the nerve trunk extending from the plexus to its ultimate predetermined distribution in the periphery. If this be true then by cutting flaps from the nerve trunk we have irreparably destroyed these definite nerve paths and their regeneration is rendered impossible. In flap operations in which two flaps are made from one stump approximately one quarter to one third of the nerve is removed from each side. The damage done to the central nerve trunk from which regeneration must take place is then considerable.

More recent investigations of Langley and Hashimoto and Heilmann would seem to controvert Stoffel's theory. These authors

show peripheral nerves to possess a series of internal plexus with only definite nerve paths over extremely short distances. Were the flap cut from the area of a plexus or central to it greater damage would be done the nerve trunk than if the flap were made below the plexus. In either instance considerable permanent longitudinal loss of substance ensues. The neuraxes centrally at the site from which the flap is cut will continue to regenerate. The conducting paths having been removed these regenerating neuraxes are then apt to grow out into the surrounding tissue becoming lost and dispersed. Or they may coil upon themselves and help to form a neuroma on the nerve trunk itself.

Thus if one third to one half the diameter of the nerve trunk be cut as a flap one third to one half of the neuraxes are permanently eliminated and without the possibility of again reaching the distal stump.

Dittel and others thought by turning down a flap from the central stump that new neuraxes were carried across the defect and at the point of suture further growth of these neuraxes would follow. Such is not the case. The central flap when cut centrally and turned down is nothing more than a degenerated segment of nerve. Since the neuraxes within the nerve flap degenerate the only tissue bridging the nerve defect is the conducting paths in which the neuraxes have undergone degeneration and the sheath cells of Schwann rapid proliferation in short Wallerian degeneration the same as occurs in the severed peripheral nerve. The central flap though connected with the central stump is bent down upon itself over its connection with the central stump and thereby really offers very slight opportunity for the downgrowing neuraxes to make their way into the conducting paths. Thus these paths within the flaps mechanically are so placed that they do not come in contact with the severed neuraxes, they being practically unable to reach them. Hence the flaps do not serve the purpose for which they were intended. Furthermore they inflict permanent damage to the nerve trunk.

*Peripheral flap.* Flaps cut from the distal stump deprive the peripheral nerve of a



definite portion of its conducting paths. In Mackenzie's case a flap was turned up from both the internal and external popliteal 16 inches long and a shade less than half its diameter. By so doing he removed permanently from the normal distribution of these nerves in the leg and foot the possibility of regeneration in the area to which their funiculi would have gone. A still greater damage is done by severing numerous muscular branches from the nerve trunk. One need only recall the anatomy of the external popliteal etc. and especially the numerous muscular branches which lead from it to realize the extent of permanent damage which is done by the formation of such a flap. When a branch from the nerve trunk to the muscle is thus removed and taken altogether from out of the field the downgrowing axes are deprived of the possibility of a path from the remaining nerve trunk to the muscle. This is an extremely important point. Even were regeneration to take place and neuraxes grow down into the distal segment they would find no paths from the nerve trunk to the adjacent muscle. The muscles thus severed from their nerve branches would remain permanently without the probability of neurotization. It is of course obvious that the peripheral flap is also a degenerated nerve segment the same as is the distal segment from which it is cut.

The method of uniting the central or peripheral flaps into either the peripheral or central stumps would be of some importance if the flap method were of value. The severed end of the flap would be brought into apposition with the refreshed central or peripheral end in order that the downgrowing neuraxes might come in definite contact with the conducting paths offered in the flap.

To insert the flap into a split in the central or peripheral stump merely places the proffered conducting paths *betwixt* funiculi which are pushed aside. The end of the flap abuts in the perineural connective tissue and does not come in contact with the severed neuraxes. For proper downgrowth the severed neuraxes should lie in as close contact as possible with the conducting paths of the flap used to bridge the gap. Unless this is accomplished they

become lost and dispersed in the surrounding connective tissue. Thereby the number of available neuraxes already reduced by formation of central flaps is further diminished. Even the remote possibility of a few neuraxes finding their way down these flaps is removed by such a union. This is the method of union Mackenzie employed.

The use of nerve flaps to bridge defects is based probably upon the close resemblance in its gross appearance of a nerve trunk to a tendon. Bridging defects in tendons by means of flaps is well founded because histologically the tendon is made up of one tissue—the densest variety of white fibrous tissue. It is a unit in itself. Healing by primary union establishes complete anatomical continuity. On the other hand a nerve trunk while grossly similar in its appearance histologically is made up of two distinct elements—the conducting tubes and the neuraxes whose origin is in the anterior horn cells or spinal ganglia and which by growing out from the center come to lie within these tubes. Severed neuraxes must grow down from the central stump. The sheath cells of Schwann united to form synchytial strands serve as conducting paths. Then when two flaps are brought together union takes place automatically similar to a tendon but neurotization does not obtain until the central neuraxes have grown into the distal stump.

These considerations are in part the answer to Mackenzie's query. Why should a different law apply to the nerve than to the tendons?

From this it will then be seen that flap operations either central or peripheral cause permanent and irreparable damage to both the central and peripheral nerve end. That degenerated nerve segments are utilized in both instances. That the possibility of offering conducting paths to the severed neuraxes is almost entirely negligible. That immediate union cannot establish conductivity. Hence on purely *a priori* consideration in view of our knowledge of nerve regeneration and the histology of the nerve trunk operations by means of nerve flaps little hope is offered for the efficient regeneration of the function of the nerve.

*Experimental evidence* The above conclusions are ably demonstrated by the experimental work of Huber. Seven flap operations were performed on the ulnar nerve in dogs. By means of both central and peripheral flaps defects were bridged varying from 5 to 6 centimeters. The animals were killed at intervals up to 147 days, one on the sixty-fourth day and one on the hundred and forty-seventh. Thus both late and early stages of repair were investigated.

When examined both physiologically and histologically in no instance were any evidences of regeneration found either within the flaps or the distal portion of the nerve trunk. In sections through the region of the down-turned flaps the collapsed sheaths containing a small amount of nucleated protoplasm were found. In these no evidences of regeneration were seen.

Because of a continuation perhaps of blood and lymph supply to the flaps Huber found that they underwent degeneration somewhat slower than a free transplanted nerve segment. The rate of degeneration of the flap was the same as that found in the peripheral portion of the divided nerve.

*Clinical evidence and critical review.* A brief resume has been made of each case. In the histories certain parts will be found in quotation marks the meaning and importance of which were such that it was thought best to quote the exact words. A few phrases within the histories the author has placed in italics and they are here acknowledged.

Mackenzie's case has been discussed in detail earlier in the paper and will not again be quoted. I would refer the reader to a comparative study of both of his articles.

Neugebauer reports the cases of nerve surgery between the years 1886-1895 from Wollfler's clinic. Case 5 in his series has been referred to in the literature as a nerve flap operation and by Neugebauer is called a neuroplastic. Instead of being a nerve flap operation one of the branches leaving the peripheral end of the radial nerve was used. The length of the defect bridged is not mentioned. At the end of the month the patient was lost sight of.

The case does not concern this report and

is only mentioned that it may not again be referred to as a nerve flap operation. As previously mentioned this error probably occurred due to the various meanings the term nerveplastic has come to have. It indicates the advantage of using the specific term for each operation rather than one which has come to indicate almost any type of operation for nerve repair.

Similarly Giordano's report cited in Chupault *l'état actuel de la chirurgie nerveuse* will not be quoted. Giordano bridged a gap in the vagus by means of nerve flaps. The case showed vagal symptoms and died at the end of a year with recurrence of the tumor for the removal of which the operation was originally undertaken. The great difference in the more usual clinical manifestations of the vagus as compared with the other nerves under discussion would make a critical review of questionable value especially in view of the indefinite report of the symptoms.

*CASE* Reported by Létievant (27). Soldier 4 years old on January 18, 1872, received a grenade wound on the inner side of his right arm. There was considerable laceration of the tissues and the median and ulnar nerve ends were seen separated from each other about 5 centimeters.

A few months later the patient came to Létievant's clinic at Lyon. The wound was healed. There was complete paralysis of the median and ulnar nerves. This might readily have been overlooked had not a precise examination been made. The patient was able to hold his hat and to carry a glass of beer to his mouth. All fingers could be moved in both extension and flexion also extension, flexion, adduction and abduction, supination and pronation of the hand. Electrical examination alone established the diagnosis. The patient was treated at first with electricity.

Operation March 13, 1872, fourteen months after injury. The nerve ends were separated 4 centimeters. After freshening the ends both central and peripheral flaps were made from the median and ulnar nerves. On the fifth day the wound was infected and on the forty-fourth day April 7, 1872, the wound had healed and the patient left *Hôtel Dieu*. On June 3, 1872, 82 days after operation the patient was seen for the last time. No improvement in the condition was found.

This is the first case of nerve flap operation in human surgery. Because of the ability of the patient to perform to a surprising degree total movements Létievant elaborated his theory of *motilité supplée*. It is unfortunate that this case was lost sight of and further reports were not possible. However it illustrates admirably that the performance of total movements can not be taken as evidence of nerve regeneration for in this patient it was shown that these movements could be accomplished even before the nerve flap operation.

The case of Tillmanns has been generally cited as the first successful nerve flap operation performed in human surgery. In view of the excellent results obtained in this case Tillmanns recommended this procedure as a method for bridging nerve defects.

CASE Reported by Tillmanns (42) Twenty three years old female, 33 years of age, a servant. The left hand and fingers were paralyzed and the right hand and fingers were normal. The patient had been suffering from this condition for several years.

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This case is quoted rather extensively because it is frequently cited in support of the nerve flap operation being considered successful. There are two distinct pathological conditions presented. Both of them have to do with the motility of the hand and fingers but each has a separate and distinct causative factor.

Tillmanns in the operative report gives an excellent description of the fixation and subsequent freedom of the superficial and deep flexor tendons. There can be no question that a great part of the impairment of motion in the fingers and hand must be attributed to the imbedding of these tendons in scar tissue.

From the site of the injury three fingers wide above the wrist it is obvious that the nerve supply to the flexors of the thumb, fingers and wrist could not have been involved at this level. However, the complete absence of the median and ulnar nerves, all of the *ulnar nerves* of the hand could be deprived of their nerve supply. Tillmanns describes total atrophy in this area.

Nine weeks after the operation Tillmanns reports a slight degree of active movement in the fingers in the area of the ulnar nerve. The patient was able to perform such total movement as picking up a glass hold in the palm of the hand etc. These movements involve rather the muscles of the tendons freed from the scar tissue than the intrinsic muscles of the hand. One year later the patient writes that the movements of her fingers and hand are in every way free.

Tillmanns describes nine weeks after the operation some improvement in adduction of the fingers as evidence of nerve regeneration.

Separation of the fingers in the presence of an ulnar nerve lesion can be extensively illustrated by the extensors. Great care must be exercised to appreciate such supplementary movements so adequately are they performed. In a previous article I cited illustrations to show the degree of separation possible due to the action of the extensors in the presence of an ulnar nerve lesion. Attention was called to the fact that the action of the interossei can be better determined if the force may be placed upon a flat surface up to the metacarpophalangeal joints then holding the fingers flexed at the interphalangeal joints to prevent the patient from extending them. The patient is then asked to separate the fingers gently and without effort. If the ulnar nerve is paralyzed adduction of the fingers will all occur. However, if the flexor digitorum profundus is separated, may take place by the action of the extensors adduction may even be accomplished with the hand in the above position if the patient foribly attempts the movements—the extensors thereby brought into play. By this simple means the more marked action of the

extensors is thrown out and the paralysis of the interossei may be readily demonstrated.

In the preoperative examination Tillmanns reports extensively the individual muscular action and electrical examination. It is regrettable that following the operation equivalent examinations were not made and that in place of reporting total movements individual muscular action was given. Had this been done there would then be no doubt as to the results.

It is submitted then in this case so frequently reported as successful in support of nerve flap operations that two distinct procedures were involved. One, the formation of nerve flaps to bridge the defect in the median and ulnar nerves. Second, freeing of the deep and superficial flexor tendons from dense scar tissue which had bound them into a tendinous knot. It seems more probable that the total movements described both by the patient and Tillmanns are rather to be ascribed to the freeing of the tendon than to the bridging of the nerve defect. Even the slight increase of adduction of the fingers noticed by Tillmanns could be readily attributed to the action of other muscles the movements of which were now freed by the liberation of their tendons from the scar tissue.

**CASE 3.** Reported by Dittel (1). A young girl twenty-two years old on December 8, 1900, as caught in a washing press and received an extensive ragged wound of the right arm about 5 centimeters long and 7 centimeters wide. About 7 centimeters above the internal condyle the peripheral ulnar stump was seen. The central stump was not found. It was estimated that at least 5 centimeters must have separated the ends. Sensibility and motility in the ulnar nerve area were absent. The wound was cleaned and an antiseptic bandage was applied. When seen on the following morning sensibility in the ulnar nerve area had returned and remained throughout.

The only difference in motility between the right and left hand was that flexion of the proximal phalanx of the fifth finger was normal in the remaining phalanges less so. She was unable to squeeze as strongly with the fifth finger as with the other hand.

January 11, four weeks after the injury the granulations were deemed fit for skin graft and both skin graft and repair of the ulnar nerve were undertaken. The nerve ends were found separated approximately 9 centimeters. The central end was enlarged and the peripheral was very much smaller and showed no visible evidence of degeneration. A flap 7 centimeters long half the diameter of the peripheral stump was raised and a flap 5 centimeters long from the central. They were united with catgut.

In order to cover the wound a skin flap was made which later partly sloughed. On March 5, 73 days after the operation electrical examination gave negative results. On March 11 electric irritability had returned.

It was thought that by turning up the nerve flaps the conduction might be reversed that is the centrifugal becoming centripetal and vice versa especially so since the axes cylinders in both flaps remained unbroken.

Dittel explains the apparent abnormal retention of sensibility by anastomosis of the sensory nerves of the skin in the upper extremity. At the time of this report the work of Sherrin, Head and Rivers distinguishing the various forms of sensation had

not yet appeared. We do not know in this case whether the more superficial types were investigated particularly touch or if deep sensibility by means of pressure was tested. Deep sensibility is the usual form of sensation tested when slight pressure is made on the part such as squeezing or by pressing with the pencil point etc. This is done by some thinking that they are testing tactile sensation whereas in reality such a method of examination calls into play a totally different mechanism. In the upper extremity deep sensibility is very seldom wanting except over very small areas in any single nerve lesion.

Dittel's attempt to explain the first electrical examination following the operation on the grounds that the axes cylinders in flaps remain unbroken and that there might thus occur a reversal of the current is obviously erroneous. We know that the axes cylinders of the central stump become degenerated when they are cut centrally and turned down and that those of the peripheral stump undergo degeneration the same as the peripheral segment.

In the examination a little over 2 months after the operation Dittel does not mention what muscles showed electrical response. No mention is made of the smaller muscles of the hand so important an index of ulnar nerve function. No reference is made following the operation of any sensory examination. Without this data it is impossible to consider this case as successful. Dittel recognized however that insufficient time had elapsed and that it would be better to await a longer period before considering it a success.

The case lacks in a marked degree sufficient data to warrant the assumption that any regeneration has taken place and must be placed in the category of premature reports.

**CASE 4.** Reported by Brenner (5). A nerve flap operation was performed 10 years after the original injury. The patient came to the clinic on account of ulcers of the leg. As an associated finding a median nerve injury was discovered. The patient stated 10 years previously that he received a knife wound at the level of the wrist. Occasionally pressure over the site of the injury caused pain. At the time of examination the patient's second and third fingers were usually held flexed at the metacarpophalangeal joints though the tendons and joints functioned normally. The skin of these two fingers was bluish in color and the fingers were distinctly more slender than the corresponding ones of the other hand. The nail of the index finger was thickened and curved. The palmar surface of the two fingers and the ulnar side of the thumb showed anæsthesia to pinprick whereas over the rest of the hand the sensation was normal.

On June 18, 1889 the patient was operated upon. A large neuroma was removed from the central stump, the distal was found lying between the tendons beneath the ligamentum carpi transversum. With the wrist extended the nerve ends were separated by 4 centimeters. A flap 4 centimeters long from each end was cut using one half the diameter of the nerve. A flap was made on the ulnar side of the central stump and the radial side of the distal stump. Each flap was then sutured to the severed nerve ends. The hand was held in extension.

To seek further pertinent snato  
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In the pre operative amputation no ment on is made of the movements of the muscles of the thumb. From the site of the lesion it is probable that only those fibers to the muscles of the thumb the two radial lumbricales and the sensory fibers are severed. The description of the position in which the fingers are held the appearance of the skin and the tapering of the fingers together with the changes in the nail correspond to the picture often seen in incomplete median lesions at this level.

Brenner reports two weeks after the operation complete return of the sensation in the (mer) anesthetic area. We know that immediate return of sensation can not take place even in a primary suture in which the peripheral nerves have not yet undergone degeneration. In a secondary suture undertaken within a short period after injury at a time when the electric proliferation of the sheath cells of Schann and accord n to some the presence of neurotropism immediate recovery does not take place. In this case the peripheral sensory ment had been severed from the central for a year. In it there is no doubt considerable new connective tissue the sheath cell had ceased to proliferate and there would likely be no neurotrophism to guide and stimulate the dotting growth of new axons. Hence such data as evidence of regeneration following nerve flap operation in view of our present knowledge can not be accepted.

The amputation a year later gives no further indication of advanced or developing regeneration. At this time trophic change is still present though these are usually the earliest to disappear.

The fact that the patient held the second and third fingers flexed at the metacarpophalangeal joints and that they no participate in all movements of the fingers offers no evidence of regeneration since the median supply to the flexor muscles come off long before the nerve reaches the site. It is remarkable that this case is inconclusive. It rather tends to show that at the end of a year regeneration had not taken place.

Gliss reports the cases of nerve suture from Brunns clinic from 1884 to 1899 presents 13 cases thirteen nerves sutured in one only was a nerve flap done.

CASE REPORT by Gliss (4) A 35 year old male patient who had been employed as a cooper after the amputation of the left arm at the elbow joint. The patient had been employed as a cooper for 15 years.

Examination of the patient showed that the patient had been employed as a cooper for 15 years. The patient had been employed as a cooper for 15 years.

It is on the basis of the following facts that the patient had been employed as a cooper for 15 years. The patient had been employed as a cooper for 15 years.

On February 8, 1888, the patient was admitted to the hospital. The patient had been employed as a cooper for 15 years.

The patient had been employed as a cooper for 15 years. The patient had been employed as a cooper for 15 years.

On July 13, 1888, the patient was discharged. The patient had been employed as a cooper for 15 years.

In March 1890, the patient was readmitted to the hospital. The patient had been employed as a cooper for 15 years.

Gliss reports is fairly complete and his conclusion that the patient had been employed as a cooper for 15 years. The patient had been employed as a cooper for 15 years.

The case of Professor Bobrov of Moscow is extremely instructive and interesting. Spizarny assistant in the clinic of Bobrov presents the case together with four others in his extensive review of 100 cases of nerve suture and gives details concerning the case which do not appear in Bobrov's last report in the same journal. It is in referring to this case of Bobrov as unable to give any complete data concerning the case since it was published in Russian and was inaccessible. In order that this case may be available in the English literature it was thought advisable to quote the case history as reported by Bobrov and in addition quote from Spizarny the details which are not given in Bobrov's report.

CASE REPORT by Bobrov (4) D. 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

posterior surface of the thigh was covered with scales of epidermis and in some places there were pustules. The swelling was painless. It interfered with walking and sitting only because of its weight. All the movements of the affected extremity were performed but it was noted that there was a certain decrease in sensation of the leg and foot. The swelling according to the patient is about of 30 years standing. At first it was small and then especially in the last few years the growth has markedly increased.

October 6 1893. I performed an excision of the tumor. The tumor proved to be sharply bounded and enveloped in a solid connective tissue sheath. It originated seemingly from the sciatic nerve the latter was firmly adherent to the center of the tumor near its inner surface and the flexor group of muscles were slightly moved apart. In order not to leave part of the tumor I had to cut out both the tumor and the whole trunk of the sciatic nerve over an extent of 10 centimeters. After removal of the tumor a plastic operation on the nerve was performed turning back 4 and 8 centimeters from either end. Transverse incisions were made into the nerve trunk up to half of its diameter and from here the ends of the nerve trunk were split longitudinally to within 0.5 centimeters of the nerve ends. Nerve flaps thus formed were thrown against each other and the ends sutured together with catgut. The wound was sutured without drain. The extremity was flexed at the knee in order not to stretch the sutured nerve. Over an aseptic bandage a plaster was placed.

The microscopical examination showed the neoplasia to be fibrosarcoma myomatodes the nerve fibers were separated by richly growing connective tissue.

On the day following the operation it was found that there existed a paralysis of movements and sensation in the whole foot and also absence of response to electrical stimuli of the muscles of the leg. The wound healed by primary intention twelve days after the extremity was extended. On the twenty-fifth day the patient was allowed to walk. During his further stay in the clinic although massage was used there was noted a slight foot drop.

The patient began to walk pretty well but he had to raise his left foot higher because the foot on account of its weight hung down. On moving the extremity forward the toes dragged on the floor. Thinking that afterward the foot drop might increase and that the movements could be materially hindered I offered to perform an operation upon the right ankle in order to obtain ankylosis of the ankle joint. The patient did not permit the operation and as it has shown now (one and a half years after the operation) our fears were unfounded.

At present the patient is able to use his extremity totally satisfactorily. He walks better than last year the foot on raising and moving the limb hangs down very little. Ever since the operation the patient has never caught the toe of his boot on the floor and has not experienced any special inconveniences from his paralyzed foot. In October he noted on the plantar surface of the heel a small suppurating surface which made him come again to the clinic. Here we found a trophic ulcer about the size of 3 kopeks covered with weak granulations. The whole foot with the exception of a small part on the posterior and inner surface where the long saphenous ends is insensitive on the leg just above the ankle (and higher up) the sensation (pain and touch) is preserved. While walking the patient does not feel the ground and it seems to him that he is resting on the end of his leg. The muscles of the leg do not respond to electrical stimulation. The size of leg and foot at present just the same as last year and the leg is bigger on the affected side.

# MEASUREMENTS OF FOOT AND LEG

|                  | Affected side    | Normal side    |
|------------------|------------------|----------------|
| Upper one third  | 35.5 centimeters | 34 centimeters |
| Middle one third | 9 centimeters    | 25 centimeters |
| Lower one third  | 24.5 centimeters | 2 centimeters  |
| Foot in middle   | 26 centimeters   | 24 centimeters |

On superficial examination there is evidence that the subcutaneous cellular tissue is infiltrated the infiltration is solid resembling such as we meet in old ulcers of the leg or in the primary stages of elephantiasis. In discussing this case I recall a case of the traumatic trophic neuritis of the lower extremity concerning which I made a report to the Surgical Society in 1890. (See the *Annals of the Surgical Society* 1890 No. 4.) There we noticed in the patient who was a laborer that after a traumatic lesion of the nerves of the sciatic plexus (which took place 12 years before) a considerable paresis of the internal popliteal nerve and a *mal perforant du pied* which was present for the last two years. Together with the ulcer there was an increase in growth of the subcutaneous connective tissue of the foot (a microscopical examination of the removed foot was made) and an hypertrophy was found partly on the leg and the tibia. All this seemingly depended upon a trophic derangement of traumatic origin.

Here at present we also see the increased density of the subcutaneous connective tissue and probably degeneration of the muscles into connective tissue which now puts conditions to the increased degree of immobility at the ankle joint. Thus the paralyzed foot proposes to be a mighty good support in walking. As further treatment it is necessary to teach the patient to look after his foot so that ulcers will not be formed as a result of excessive pressure or dirt in case they should appear to treat them immediately so as not to lead to the formation of a deep perforating ulcer as occurred with the laborer.

In the literature I found a case similar to ours by Trélat 1875 where also a fibrosarcoma of the sciatic nerve in a young man was removed as well as centimeters of the nerve. Half a year later the patient as reported before the Surgical Society of Paris and attention was called to the fact that the patient was able to walk fairly well. In this patient the early atrophy of the extremity was noted and also drop foot and an increased scarring of the skin.

Exactly similar cases were described by Marchand Bouilly and Bardenheuer.

From this it follows that the removal of the sciatic nerve for a great distance even though one does not succeed in restoring nervous conductivity by a plastic operation does not lead to the necessity of removal of the extremity because after all we get an extremity fit to use.

To this report should be added the additional details given by Spjarny.

After the operation there was complete paralysis of the foot. The sensation in it was only preserved in the part supplied by the saphenous nerve. On the following day drop foot was found. After the third day shooting pains appeared in the foot referred to the toes. Sensibility as without change. On the sixth day as noted that sensation had returned in the whole foot with the exception of the volar surface of the big toe and the remaining toes. Sensibility in the leg then appeared. After 12 days when the leg was finally extended the movements at the knee were performed freely the flexors acting well. After 25 days the patient started to walk though slightly lame. Examination of the electrical excitability gave the following data.

|            |          |          |
|------------|----------|----------|
|            | N mb 3   | D mbe    |
|            | CCC ACC  | CCC ACC  |
|            | m li mpe | m li mpe |
| MB p       | 5        | 3        |
| MG tocm m  | 5 qu k t |          |
|            | a od     |          |
| MPe n s    |          | 3 ck     |
| MII ggt um | 3 k      | c nt at  |
| M tend n s |          | 4        |
| Nrv Tbl s  | n o      | no       |
| Ne ePr e   |          | n no     |

I w l k g t h p u t d a g d h i f o t b t b b g a t  
w l k t f c t n l y A t a n i r e o f t h e t r b y o f  
t h e t m t y o t e d B c u t h a t o f d e g  
r t o n w a f o d t h m u l e o f t h e l e g p a t n  
w s g g t d n d t p r d u k y l s o f t h a n k l  
j o n t l t h a t s n e r y t n t t h e q u t q k  
c t r t f t h k n e t n a d p p e r a n f i f u  
t n s f t h f l e r s f u l e g b p m t d d  
t n m e m b a s m u c l e

Bobrov and Spijary's presentation of this case is both instructive and interesting. Spijary is amazed that after such an extensive excision of the sciatic flexion of the leg on the thigh should have returned so early. When the leg was straightened after having been held in flexion for days the patient was able at once to rest the leg upon the thigh the flexors act well. Since the patient's leg as held in flexion on the operation up to this time the power of flexion in these muscles can not be said to have been absent. In any case as soon as the leg was freed and the opportunity given for them to contract they contracted freely.

From this study of the case it is extremely instructive. It demonstrates admirably the dual nerve supply to the biceps and semitendinosus and that function is retained in these muscles even when the sciatic is removed. It is also over an extensive area Bobrov comments on the condition of the muscles of the leg displays a brilliant judgment. He recognizes that the increase in the size of the leg on the affected side due to infiltration of the tissue and the connective tissue changes within the muscles have brought about a lessening of the foot drop and a decrease in mobility within the ankle joint. It appears that such control of the foot is due to degenerative changes within the tissues and not to nerve regeneration as Mackenzie interpreted his case.

Bobrov's conclusion that he had not succeeded in restoring nerve conduction by means of a nerve flap operation is entirely substantiated by his findings.

Before the proceeding of the Society of Physicians May 1895 Brun presented briefly a case of successful secondary nerve flap operation.

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f t h m l g y n r v e t a t t h t u m  
d t k

April 1895 5 months f r e m l o f t u m o t h e p a t t  
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n r a d h e l d d r s d e d T h p o m a l p h a l g s e  
e t d d d a n d t h e e m a n n p h a l n f l e d B t h  
m e d a n d u l n a r m u s c l a t r w e c o m p l t y p a  
l y z e d C o m p l e t e a t n f d g e n r a t o n A l e s a o f  
t h e p a l m a u a f i t h h a d

O n A p l o 895 5 m o t h s a f t e t h p e a t  
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u l n a d m d m u s c l a t u r e o f m p l t l p  
l y d I t h f l o m c u l t r e f t h e f l m  
t t o f a d c r r t q t e l y s l w g a l n

O t h t h r h d B n a b l e t o o b t i f t h m  
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A t t h t i m e M a y 895 t h e p t t r v a r  
o m t h o l d d s b l e t m o f e l y t h l t h  
i g t h t h m b n d d f n g r r t l l m h a t  
l m t d M c l t f t h t e m e c a t a l y  
f t u n ( p p o t o d d t o) t h u l a f e r  
a d p t f t h m m f l e f t h f r m a b  
t m l t d t h f a d c u r e n t F t h r e d  
m u s c l t e t h o t o m s n t y t q t d r m d  
T h e p u t u e t h e h a n d t t d t o p l y I t a s s m  
w b t m l r t h n t h l e f t h n d t h r t h r  
t p h e d t b a e

The evidence in this case shows considerable regenerative action in the area of the ulnar nerve and less so in the median. It is well known both experimentally and clinically that nerve regeneration is a very much more active the younger the individual. Unfortunately the distance separating the nerve ends as not more specifically stated than several centimeters. It is a well established fact that nerves without substance may bridge short defects. Notta Von Langenback, Heister, Weir Mitchell and others have reported cases in which such defects were bridged. By some the distance which may be bridged is considered to be about 3 centimeters. Turnin up nerve flap for so short a distance (several centimeters) may have served in this case to hold the nerve end in alignment the nerve flaps in this instance played a small rôle to suturing a distance with catgut. It would be hard to rule out this possibility as a means of regeneration in this case. And on the other hand it could be quite difficult to attribute the recovery to spontaneous denervation of nerve tissue except that it is known experimentally that in the young the nerves have tremendous powers of regeneration and that from experimental evidence the nerve flap probably does not serve as a conducting path.

CASE 8. Reported by Habermann (20). A young girl 28 years old in April 1893 began to complain of pain in the right foot mostly over the dorsum and over the toes. The pain became so severe that the patient was hardly able to stand the weight of the bed clothing on the foot. Sitting down caused extreme pain.

Immediately beneath the sciatic notch a freely movable tumor was to be felt. Examination November 7, 1896 showed motor and sensory function of the right leg to be completely normal.

In June 1893 diagnosis of tumor of the sciatic nerve was made. The patient was handled symptomatically. The pain became more severe and on November 7, 1893 excision of the tumor to either 10 centimeters of the sciatic nerve was performed. The defect was bridged by means of a nerve flap. Both the nerve and skin wound healed per se.

On the tenth day after the operation a distinct return of sensation as noticed pain was completely lost. December 25, 1893 patient began to try to walk and in September 1894 was able to walk freely.

Numerous other tumors appeared over different parts of the body and several operations were performed. In all it was surprising how little impairment of function occurred following nerve excision.

Habermann in discussing this case is more concerned with the pathological aspects than with the repair of nerve defects. In the subsequent operations the ultimate outcome of the case was no doubt apparent and no attempt was made to perform nerve suture.

From our standpoint the case is lacking in both preoperative and postoperative findings to merit further consideration. Individual muscular action is nowhere noted total movements only being given. On the sensory side no definite forms of sensibility were recorded nor areas of changed sensation outlined. The case is recorded so that list of nerve flap operations may be more complete.

CASE 9. Reported by Paul Cindt (19). W. A. a medical student on January 15, 1898 received a blow in the right forearm 1 centimeter below the internal condyle and extending down and 7 centimeters. One and a half hours after injury repair of the brachial muscles (not stated which) and the ulnar nerve was done. Infection took place and a necrotic piece of nerve was discharged from the wound. After the wound was healed (time not stated) a secondary suture was performed. The nerve ends were found imbedded in scar tissue and separated by 3 centimeters. A distal flap was turned up to the central end and there sutured. Eight months after the operation the fourth and fifth fingers were still maintained in slight flexion and the hypotenar eminence was atrophic. Sensation over the fifth finger was still impaired. Motion was nearly normal and also reaction to the faradic current except in the muscles of the hypotenar eminence. The interosus reacted nearly normal and the same for the flexor carpi ulnaris. The patient is again able to use hand completely. The result is very satisfactory and I doubt not that with further electrical treatment complete cure will take place.

Judging from the site of the injury 10 centimeters below the elbow there should have been no paralysis of the flexor carpi ulnaris or the deep flexors to the fourth and fifth fingers. The only impairment of

function attributable to the nerve injury would be in the intrinsic muscles of the hand. There is no conclusive evidence given in the report of return of function in these muscles. The hypotenar eminence still shows atrophy and the fifth finger loss of sensation. This report is made less than eight months after the injury and is both incomplete and premature and hence does not admit of any final deductions.

CASE 10. Reported by Debersaques (11). In a man 48 years old a sarcoma was removed to either 12 centimeters of the sciatic nerve. The tumor was about the size of a child's head lying between the biceps and semitendinosus. Both nerve ends were split in half longitudinally and 7 centimeters flaps were made. These were united with three chromic catgut sutures.

Sensory changes occurred on the outer side of the leg and dorsum of the foot. Six days after the operation sensation was normal. A light paresis remained in the anterior and lateral muscle groups of the leg.

A discussion of this case would be superfluous in view of what has already been said concerning such early return of function and the absence of sufficient data. Furthermore the case remained under observation only one month.

Subbiotich in reviewing nerve surgery for Serbia reports a case of nerve flap operation performed by himself. Apparently the case has not been elsewhere reported and the details given are extremely brief too meager to admit any valuable deduction being drawn. It is quoted in order to make the list of nerve flap operations as complete as possible.

CASE 11. Reported by Subbiotich (41). At operation 14 days after the accident I searched in the scar tissue for the deep root of the musculospiral nerve, freshened both stumps and sutured the nerve. The suture had to be preceded by the formation of a small flap in order to elongate the nerve and bring its two extremities in contact union by first intention was incomplete and the result showed no return of function.

CASES 12 and 13. Reported by Medea and Posi (9). A brass worker was caught in a fly-belt. August 6, 1903 sustaining a fracture of the humerus middle third and both bones of the forearm middle third. After union of the fractures a paralysis of the radial nerve was discovered and progressive atrophy of the forearm and hand.

On May 13, 1904 examination showed extensive callus at the junction of the middle and upper third of the humerus, callus and some deformity at the junction of the middle third and the upper or third of the radius and ulna which limits enormously supination and pronation, paralysis and atrophy in the radial area with the cephalic of the triceps and supinator longus muscles some anesthesia in the middle of the posterior surface of the forearm corresponding to lower intercutaneous nerve.

Electrical examination showed complete reaction of degeneration in the musculospiral nerve in forearm, a slight quantitative diminution of the other muscles especially the interosus.

Operation May 5, 1904. 8 months after injury. Incision made four fingers breadth above the elbow over the course of the musculospiral up to the junction of the middle and upper thirds of the humerus. The radial nerve was



emb dded n car and all a d plaes d ed t a  
 si gl n ect et s b nd t d d e dam t f  
 the no m l n Re t n m de nd 8 t m t s  
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 l tr l am at

In commenting upon this case Medea and Ross believe that a better result had not been obtained due to the fact that the nerve flap operation as undertaken 8 months after the injury and that because of the formation of flaps and the distance bridged a greater time could be equaled than if direct suture had been done. Their conclusions would seem to be arranted.

No doubt the report is made too early and that no evidence for or against the nerve flap operation can be deducted.

Medea and Rossi state that sensibility is a little better and that a little improvement is to be noted in the electrical emanation. From a critical standpoint such remarks unfortunately indicate very little. The question naturally arises: What form of sensation has shown improvement and to what extent have the borders of anesthesia been retracted? Such evidence if given could afford some index of regeneration. As reported at this time the case must be classified as premature and unfortunately no evidence can be deducted in support of nerve flap operation.

CASE 4 p 7 N t n y a l d b y g k r  
 o l r v 4 r d a l l t p l t a l g n  
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 d d p r f l n d l d th t k t  
 T d y f t h p t d t o d O p d l M g g  
 E m a t u l e d n d o b n m t m e l l  
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 popl teal face

Th r an t t m f t wh ch b l g g  
 f the tr p l t l s t a d p d f t g  
 T l g t n n d t Th t t h l n  
 of g t t n th t u l t n d t m  
 l s f o t A f d y s l a t h y m p t m r d d  
 in t t of l a u d l t m f a t o s g t d  
 C y s h a b o m m k d d h t d d p t h  
 h l l g t the l r t h d of the th g l pati t  
 h l d the l g l g h t l y f l d m o m n t th k j t  
 e l m t e d f e n t o o  
 l n t a s i o of th f t and to s t p b l o  
 c u n t o f p l y f t h f t e a l p p l l M  
 m t s the g n f t h t l p o p l l j r e t  
 E m n t f n t o s h a f a t e n  
 th foot p l n g t the t l m r g n d o c p y  
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 tions th l y p e r a t m e m r k d th p l n t  
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Fl t t l a m i a t n h s e c t n o d g r t i o  
 n the a l the n t r l p p l t a l Achil s r e f l e h  
 d s p r r d  
 D g f a m d l o f the t m l p o p  
 l t l r m d B o f t p a r q t f t h e  
 p t t r m n d n l b y o s 7 d y  
 f t n j u r y a d m a l k a f n d The t r a l  
 p p l t l p d d t l e p j p a r t f t h p o p l a l  
 p a d f l l d d n l t f u n d r e d 4 c t i n  
 m t s p r t n g t h l p o m a d d t l l g t n  
 l g t p l t l t r y a m d A i p a t m t r s  
 l g t g f h l f t h d m e t r f t h t l p o p  
 l t l n t h t f h l f b e g t k w m a d  
 O a o t f t h t r l o m p l t n d e m d  
 b t o t t y t f t h k i d e t o b g t h g  
 m t t g t h W l h a l d p p  
 O t l a t h m t h m t o d j u m b l y N a h y  
 th p t n t o m p l i m t n i n e l e f t h f o o t  
 o t l g t h s o m m p m t m l t y s t d  
 l l t f l e f t h t t t t t l m t m p o b l  
 b i t k t b m p l t l h g l a k Th m p  
 m t n m t t t d d l l y h t h e m  
 i n b l i v h d m r k l m p m t j  
 J e s f r m t h a t d t n l t v b g n t b n m l  
 l f t m o t h a f t t l t p e a t M y 5 o o  
 t h d t l t h l t m t r g n d m  
 p m t m t t y a f m t f t t a l t e  
 Th r m d t l l f l l y p l n t n f t h  
 t A h u l s f l v a k s t n h a b m  
 p f e l y m f E l t a l m t f t h g a t r  
 m u d t t a t t h f d a d g  
 l m t r j s e t t g l t S t m u l t  
 f t h t b l t g l y a e k n t r a t

The case certainly points of extreme interest in this case particularly the very quick recovery of plantar flexion occurring about 35 days after the operation—a period too short to permit of nerve regeneration and the reformation of the motor end plates. It must be recalled that the level of the knife wound was centimeter below the joint line. The musculo-vascular branches to the inner and outer heads of gastrocnemius come off from the internal popliteal nerve a little below the apex of the popliteal space—higher than the level of the second wound.

In order to determine this point two experiments were made on the animal. The internal popliteal nerve exposed centimeter below the line of the knee joint—this level being determined by inserting a knife into the joint cavity and by marking the skin by means of a skin pencil. The popliteal space and upper one third of the leg were dissected. The two nerves to the heads of the gastrocnemius were found high up in the popliteal space about 5 centimeters above the point at which the internal popliteal had been severed. These branches immediately diverge from the nerve trunk to enter the substance of the gastrocnemius and at once begin to send off short filaments to the muscle. At the level at which the internal popliteal was severed these two nerves lie approximately 3 centimeters lateral and mesial to the nerve trunk. These nerves might then probably have escaped injury and thus the early motility in these muscles might be accounted for.

Due to the intense tumefaction and excessive pain

these muscles no doubt were held in a fixed position established by the pain reflex. Hence the Achilles jerk might not have been obtained though present. The above anatomical findings might be suggested to account for the almost immediate return of plantar flexion of the foot. However against this Medea and Rossi state reaction of degeneration was present. This examination was made a few days after the injury. We know that the reaction of degeneration does not occur generally until some little time has elapsed after nerve severance—rarely under two weeks and more often three weeks. In the presence of extensive oedema as here described both sensory and electrical examination can not be done with accuracy even slight oedema would interfere with the passage of the current.

However there would seem to be one point of evidence which has been constant throughout. There could be no question of the severance of the nerve supply at the time of injury to the flexors of the toes. At no time following the nerve flap operation has there been any return of power in these muscles.

It is regrettable that more details are not given in this unusual case. One can not help seeing the necessity for greater uniformity of accuracy and detail in the published reports of nerve injuries.

CASES 15 and 16. Reported by Goldmann (16). A woman 48 years old noticed for the last six years a tumor at the level of the right elbow. During the last 10 years she complained of pain which prevented her from working. Pressure over the tumor called forth marked pain referred to the fifth finger. There was no motor or sensory paralysis.

On February 7, 1905 a tumor of the ulnar nerve was removed together with 5 centimeters of the nerve trunk. The defect was bridged by means of central and peripheral nerve flaps. *Healing per p. mam.*

After the operation there was no disturbance in the motility of the hand and fingers. Sensation was lost over the fifth finger.

Ulnar flexion of the right hand was undisturbed on traction of the flexor carpi ulnaris as distinctly felt. No difference between the right and left hand. Spreading and closing of the fingers at a moderate tension of the distal two phalanges was possible. The thumb adducted equally on both the right and left. The opponens and flexor digiti minimi contracted. No muscular atrophy.

At the ulnar point above the wrist the ulnar nerve can be stimulated by the faradic current. All ulnar muscles respond to galvanic and faradic currents. No reaction of degeneration.

Hypesthesia over the whole of the fifth finger and hypothenar eminence. The remaining ulnar area shows no loss of sensation. Trophic changes appeared over the fifth finger.

May 19, 1916 15 months after operation there was still no atrophy of the muscles of the hand or of the flexor carpi ulnaris. No distinct flattening of the hypothenar eminence or depression of the interspaces. The adductor pollicis was distinctly palpable.

Flectic examination in the arm and upper two thirds of the forearm gave no response to either the faradic or galvanic. At the ulnar point above the wrist a distinct contraction of the ulnar musculature could be obtained. Sensibility is impaired over the fifth finger and along the

fifth metacarpal also slightly on the ulnar side of the fourth finger. Temperature sense is less disturbed than pain and touch.

After removal of 5 centimeters of the ulnar nerve above the elbow no motor paralysis appeared and only some impairment of sensation over the fifth finger and hypothenar eminence. There was no disturbance of the motility of the individual ulnar musculature. Had not more detailed evidence been given this case might have been included among those of immediate return or in the category of supplementary movements. Electrical examination above the site of the nerve flap operation gave no response in the ulnar distribution which precludes the possibility of such interpretation. The fact that stimulation of the ulnar nerve at the wrist gave full response in the ulnar domain of the hand would seem to point to the presence of an abnormal communicating branch probably between the ulnar and median as referred to by Halpern.

The only clear manifestation of nerve section was the loss of sensation of the ulnar area of the hand. This persisted throughout and in spite of reestablishment of continuity of the nerve trunk by means of nerve flap. 18 months after operation the sensory impairment has remained unchanged as the only evidence of nerve resection. Thus following the nerve flap operation and reestablishment of nerve continuity no improvement had taken place.

CASE No. 2. The patient presented herself on July 3, 1904 complaining of pain referred to the fifth finger and a swelling in the right forearm five centimeters above the wrist. Diagnosis of neuroma of the ulnar nerve was made. Motility of the finger and hand as normal.

Operation. 15th removal of 5 centimeters of the ulnar nerve. Defect was bridged by both central and peripheral flaps. An examination made almost immediately after coincides with the examination made June 3, 1906 two years after the operation. The fifth finger is held in abduction the remaining little at rest are held lightly flexed. This position can be corrected at will without much effort. It is impossible to flex the second and fifth fingers at the metacarpophalangeal joints with simultaneous extension at the interphalangeal joints. With each attempt to perform this movement the distal phalanx is flexed. The patient readily performs the correct movement with the other hand. Adduction and abduction of the second to fifth fingers is possible with the exception of adduction of the fifth against the fourth. Both the force and amplitude of these movements are markedly diminished. Adduction of the thumb is present but is more or less diminished. Flexion of the fifth finger is markedly diminished opposition somewhat better and radial adduction not at all possible.

There is marked flattening of the hypothenar eminence, slight depression at the site of the adductor pollicis and distinct atrophy over the intero-sei.

*Electrical examination.* By stimulation of the ulnar in the arm only contraction of the flexor carpi ulnaris was obtained. A distinct response of the muscles of the hypothenar eminence and the lumbricals by stimulation in the arm could not be demonstrated. In the forearm the adductor pollicis and the abductor of the fourth finger can be readily stimulated.

G l ga al of th m l a t o  
 Sr t r m ha cal o l tr l r tability  
 a d tempe t r n d l the fifth fng t tle  
 tre ll a r th tp f th fifth f g s  
 q n t t t l y d m i h d

In comment ng on th s case Goldmann states that follow ing the operation there occur merely a diminished action in the ulnar musculature which in the course of two years has not improved in spite of reestablishment of nerve continuity by means of nerve taps. This conclusion is amply supported by both the motor and sensory findings as it is by the presence of tripharyngeal hypothermia eminence the interscutaneous and the adductor pollicis. The description given of the attempts of the patient to tend the distal phalanges of the second fifth fingers is very characteristic of paralysis of the ulnar nerve. Extension of these two phalanges is a function of the anconeus. In this case that function was totally wanting at the end of two years. Goldmann describes a method of electrical paralyzation of the nerves. This is a little before in the ulnar paralysismy be accomplished by the extensor muscles.

The certain *unus al features* the electrical reactions which Goldmann has used as evidence in support of absence of loss of function following resection of a peripheral nerve. The discussion of this theory could hardly come within the scope of this paper.

However several interesting points are suggested in these three cases because of the remarkable fact that following the removal of five centimeters of the ulnar nerve no paralysis or only slight paralysis occurred. The findings seem not to be rare following removal of slowly growing tumors from peripheral nerves especially the ulnar. Extension formation of communicating branches according to Schede and Goldmann affirmed in the same manner as the collateral circulation established after ligation of a blood vessel. However while such to maintain the rule in the vascular system it is the exception in the nervous system.

A further possible explanation may be found by the not infrequent communication branches between the median and ulnar nerves present in about one in five cases according to some anatomists. Considerable ability seems to exist in the peripheral distribution of both the median and ulnar nerve the median taking over part of the ulnar distribution in the hand and the reverse. Halper has emphasized such a case. The ulnar nerve was completely severed above the elbow with complete loss of sensation over the fourth and fifth fingers but with atrophy of the small muscles of the hand and very slight in the forearm. At peroneal stimulation both ends gave no response but when stimulated to downward contraction occurred in the peripheral distribution of the ulnar. It would not seem improbable that perhaps these other cases of Auback and Brodnitz and Goldmann might be accounted for in the same manner.

Care Report by A. Back and Bodst.  
 Ni t n a old bal r hip p s ted hm li o  
 Jan ry 4 o 8 e mplan g f pan n th f of  
 th fr m d l ft ha d Th fou th a d fifth f f  
 f l l d ad n th m se t a l imp d  
 D g f u of b ma f the ul a e e  
 y d r t s m d E am n t th m th  
 p ul n n th r l e ho d the fifth m to h e  
 b ome hat cy t and th sk smoth d sh y  
 Th p e t m t n al d hyp th  
 I ar d f the ha d a d lo er th d f th f m  
 anstl a of the h l f l e fifth f g d th l a  
 s d l th f th  
 M k d r t r p h f th th d f o th int s u  
 pac th d d t p l l c and th hyp th n m n e  
 Th f t f th m s l s a d st th l n d  
 L l t l c t f th th d a d f u th int u  
 p h d p l a q l y a o d l t n t n  
 q l d k th d f c t t O th er v tr u k  
 b th t m o ly tro f r d d g l a e t s  
 g y t n n th t r r p u l d o  
 e t the d d u to f l th n t o s H  
 th n t r s t d th t c r t t th  
 ul r p t at th r t  
 B of the ing p n d ap d g th f the  
 tum e c p s m i j nuary o o 8 a l  
 s t m t e s f th l t s m o d Th er e  
 det t b r d d by both t l d p e r p h a l flap  
 H f g p p  
 Th pat t s d r b e t for f t a b l f  
 m th alt p at F k f pe u h  
 t d t the o k h h c t p h i  
 m ly n b l t d Th fa t m n t made  
 n the m d d l f j o o 8 At th t m th r e a n l  
 m m m m d f e n ability t app at t a l l  
 at the p l m a side f th d t a l p l f the  
 l f f f th i g n d a l m l a the th d  
 d f th n t e r s p s t l t f d g e  
 t n n l t t Th t g th of the h d  
 had t a d t r m a l l p t e f the l r g d i c t  
 t t h g that f m the t l t m o m t f t r i  
 t f ( e m l f s t m t ) l l t y k n d  
 f m p m t t m o t l y d

It is rather difficult to attempt to discuss this case from the viewpoint of binding nerve defect by means of nerve flap. In the first place observation extend only over a period of four and a half months obviously too short to admit of any definite conclusions. However evidence is noted in this case which warrants the conclusion that a result of the nerve flap operation restoration of function occurred. From a necropsy study of value and the above record.

Because of the marked similarity in the return of ulnar function following resection in a more general discussion of this case is included in the main conclusions the reports of Goldmann.

C e 8 R p o t d b y H m t a d T k a f  
 S l d g h t d Oct b 4 o o 3 c t p l y  
 E t a h t l g b n d b h d the t r a l p  
 o n d l u t b e f l d b th t a l d y l  
 Th e d d b l m h m g h t p t t  
 H t l l d n d y f t j h b g t  
 h p f r d t the l p f th foot f th  
 f th l r l g a x th d l f th foot foot  
 d p D t t t p h c h g d t p h u  
 th g n t th r i g h t t r m a l m l l

Operation January 16 1905 92 days after injury The tibialis nerve was thickened and spindle shaped the peroneus severed and both nerves were imbedded in scar tissue Six centimeters separated the ends of the peroneus nerve Ascending and descending neuritis in both nerve trunks Neurolysis was performed on the tibialis nerve Flaps were made from the peroneus nerve Eleven months after the operation the patient was able to dorsiflex his foot 95 degrees Parasthesia still present on the dorsum and sole of the foot Result good

There seems to be little question of improvement so far as one may judge from the report Unfortunately individual muscular action has not been given Such incredible rapidity in the presence of a secondary suture with which the neuraxes have bridged a defect 6 centimeters has not been substantiated by the reports of nerve injuries in this war It should be remembered that in order to have voluntary motion as exists in this case the neuraxes must bridge the defect not only but continue their growth through the distal segment and penetrate to the individual muscle fibers to reform the motor end plates It would be of interest had the authors given more information concerning the method of preparing the nerve flaps By cutting the central flap so that it is almost severed from the nerve trunk yet still connected by a small amount of tissue it is conceivable that the neuraxes might readily penetrate whereas such would probably not be the case if the flap were cut to within 1 centimeter or thereabouts of the nerve end In the former instance the nerve flap would essentially be an autogenous nerve transplant with the disadvantage however of having a poor line of union with the severed neuraxes and having been taken from the nerve trunk from which regeneration must take place thus damaging and diminishing its power of regeneration

CASE 19 Reported by Berdjajew (7) A soldier 27 years old on September 7 1909 entered the Odessa Military Hospital four months previously having received a stab wound in the left arm 5 centimeters above the joint line of the elbow The wound had been infected There was some scar tissue and the scar was adherent to the underlying muscles Pressure over the wound caused local pain The fingers were held flexed at the metacarpophalangeal joints and half flexed at the interphalangeal joints The thumb was flexed and adducted There was no wrist drop Active extension of the wrist and fingers as well as supination of the wrist were impossible Adduction and abduction was limited Electrical examination gave no response below the level of the lesion

Sensation was lost over the dorsum of the wrist and hand with the exception of the fifth finger Both pain and cold stimuli were not appreciated Operation October 10 1909 After freshening both nerve ends they were brought together through and through and four upper fascial sutures

On the following day Berdjajew reports that extension of all the fingers was possible On the eighth day when the dressings were removed the patient was able to supinate and also extend the fingers at the metacarpophalangeal joints Extension at the wrist had not been restored Pain and temperature sense had returned and the patient was able to distinguish between hot and cold

A second operation was performed February 4 1910 because there was still slight paralysis At this time there was anatomical continuity except for a small part on the periphery A slender flap 1 centimeter long and 2 to 3 millimeters wide was taken from the central part and continuity established with the peripheral end

Following this procedure the movements of the fingers remained unimpaired The patient was observed for one month and was not again seen

A nerve flap operation was not really performed in this case At the first operation the ends were brought in anatomical continuity and in the second this was not interrupted At this time a slight repair was made of a small lateral defect by means of a central piece 2 to 3 millimeters wide For this reason the case does not really concern this report It is mentioned in order that it may not again be referred to as a nerve flap operation Coste and Gerulanus both have quoted Berdjajew's case as a nerve flap operation The summary given by Coste and also in the *Zentralblatt fuer Chirurgie* 1910 p 1573 is misleading and inaccurate Quite a few inaccuracies have been found in reviewing these cases due to writers not searching the original articles

Gerulanus in treating the Greek wounded in the Balkan War performed a nerve flap operation on 4 cases In one a brachial plexus injury nerve flaps were made on 3 cords in two of the remaining cases both the median and ulnar nerves and in the fourth case the ulnar nerve alone In three of these cases no postoperative report was made the patients apparently having been lost sight of The remaining case was observed for 4½ months following operation

For this reason unfortunately no data of any value can be deducted from these four cases on which eight separate nerve flap operations were performed

Gerulanus was convinced of the value of the nerve flap operation especially by the report of Mackenzie's case which he quotes as having been successful Gerulanus' view has been shared perhaps by many and indicates the rather imperative need for a critical study of Mackenzie's and other reports

CASES 20 to 3 Reported by Gerulanus (13) Gunshot wound December 5 1912 entrance above the middle of the right clavicle exit posteriorly in the suprascapular region Paralysis of the shoulder muscles and the whole arm Sensation lost over the entire arm Atrophy of all the arm musculature The paralysis is complete in the region of the shoulder Arm and forearm musculature show severe reaction of degeneration with exception of the flexors of the elbow and fingers Complete loss of extensibility of the musculospiral and marked impairment in the ulnar and median nerves

Operation on May 20 1913 165 days after injury Considerable scar tissue in the region was found The nerve ends were freed

The fifth cervical cord over an area of 5 centimeters was surrounded with scar 2½ centimeters of this was shaved and resection was done (length removed not given) A nerve flap was turned up from peripheral end

The s th r i l cord h w ed m led scar tissu  
 ha g A 3 c t m t segm t a r m o d d v e  
 fl p r d e f o m t h c n t l t m p  
 The s th r d w a m b d d d l l s of the tran  
 ers proc f th ert b a d m b d d d m t was  
 mall b n e spli t e tion of 3 centum t d pair  
 ly m a f l p s f o m b th tumps Both th ghth  
 r v l a n d f i s t h r a c w e l u k m b d d d c a l l  
 l t e f r d n o c t i o n s m d d t h n r v  
 tru k e s r o u n d d b y f a t t y t s s u f m t h r e g o n  
 E a m i a n 4 m t h a t a p e r a t N m b e 5  
 9 3 h o d d s t i m p o m t t h a r f m u  
 l t a s d u l a l s s n t h d t b u t n of th  
 m d a n d m u c u l o p a l I n r e a s n e r t n of  
 d g n a r a t o n of the d l t d u p p a t u n d f r  
 p a t

It is interesting to note that in the eighth cervical and first thoracic roots though imbedded in callus are not excised but freed Apparently so far as one may judge improvement was found in the distribution of these cords alone

Gerulanos speaks of improvement in the area of the ulnar nerve and of amputations made in the distribution of the remaining nerves as if by such amputation on some index of the status of the injury might be elicited It is obvious that one can not discuss in this case return of function or loss of function in terms of peripheral nerve distribution The injury here was to the nerve cords and a radical amputation should have been made Not only does this apply to the individual muscular act on but also to the sensory distribution On the upper fifth and sixth cervicals and the middle (seventh cervical) nerve flap operations were performed In the peripheral distribution of these so far as one may attempt to judge from the report practically no change took place Whether as on the other hand in the lower group (eighth cervical and first thoracic) where resection was not done but the cords were freed improvement had occurred in their distribution at the end of 4 1/2 months It is well known that following neurolysis most rapid return of function may take place and in this case when both methods were employed in the same wound some idea of the relative difference might be suggested

CASE 3 p 5 G hot w d of the ght a lla  
 t n e t h n t r b d e r t h r u g h t h e s t t  
 p o t e r o l y n t h n t h r t b a  
 P r a l y of t h n i g h t a r m t e l t h f r m  
 p t n d g u n t C m p l t m e m t l t h  
 h n d a d i g r s u m p o s b l M r k d a t h p  
 c l l y t h l a a  
 E l e c t r i l e m u t a t i o n s h w d o m p l e t p r l y s a f  
 t h m u s c l p r l m d a n d u l  
 O p e r a t n f b r u a r y 22 9 3 1 6 d a y f t e j u y  
 T h e m c l p i r a l u l n r d m d a r e s m b d d d  
 i n r a n d n a r m w f o u d R e s e t o n f s c t  
 m e t r s f t h u l n N r v f l s m d f m b t h  
 e n d T h w u d h l d p p m  
 N f t h x a m a t n f l l n g t h o p a t o n w  
 m d of this ca

CASE 5 p 5 C u h o t w d J l y 14 9 3 of ght  
 a r m b l o w t h u l l W d n f t d s m e c r s  
 f t h e k n d f o r m C m p l t p l y s f l l m

m n t f t h e f r m a n d m l a t e o f t h e h d P r o  
 n a t i n d s u p a t n f l b l t h g h d t c l y i m p a d  
 P l y s f t h m u c l p r a l m d i u l n n d t r a l  
 c u t A t r i a l p l b e n t  
 O p e r a t i o n N e m b 9 3 87 d y s a f t e n j y  
 S a r t e f o d t l a l l v s l a d n e r v c o m  
 p l t e l y e r e d t h n b g s c n t m t p t t h  
 m u l o p r l e r e d s v h e l d t g t h b y  
 t M u s l s p i r a l e r v e u t c d N r v f l p e r a  
 t i o n t h u l n r u s i g e n t r a l f l a p s c n t m t r l g  
 A l r g d f e t f y e t m t r n t h m e d n B o t h t m p s  
 i m p l n e d n t h u l a

No further report of this patient was made

CASE 1 p 5 G hot n d f b r u a r y 9 9 3  
 i n t h f l t a l l r y s p e t p o t e r i l y t h o h t h e  
 s c p l p a g t h u g h t h e h t P a l y of a l l t h e  
 a r m m s c l e t h e d e m a c y o a n d t o p h y E l e c  
 t r i c a m n a t n s h e d c o m p l t p a r a l y s f a l l m l e s  
 f t h r m C m p l t e a c t n o f d g t i o n  
 O p t n d e m b 5 9 3 20 d y a f t r i n j r y  
 F r m w i t h t h e l l t t h m o d i t a e o f t  
 c a t m t r s o u n t r e a d n o e r v s e l t  
 b f d F r m b s a d b l w e c h t r u k f o d  
 a n d f l o e d T h e d s c m b e d d n a s d c a l l  
 O n l y t h m c u l o c t a u a f o u d a s h l  
 l l t h r s c o t i t y w s l o t D f e c t f o t s c e t u m t e r s  
 b d g d f m a n s f n r e f f p A m s e f l f m  
 t h l t m d o r s w a b g h t i n t t h w a n d  
 s u d e d t h n e r v H l e d p r p

No further report is given of this case The formation in this operation of a muscle flap around the repaired nerves should be condemned as stated earlier in reference to Mackenzie's case in which he pulled the nerve flaps through a muscle tunnel The presence of bleeding and torn muscle fibers does not serve to prevent adhesions and scar tissue formation about the nerve but rather tends to cause their production When in the presence of a sensitive scar as found in this case the desire to create a more favorable environment can hardly be suppressed by the surgeon However it is better to recognize that certain procedures while appearing at the time of operation to improve conditions in the end make them worse

#### SUMMARY

Thus both the experimental and clinical evidence has been reviewed to determine the value or futility of the nerve flap operation in bridging nerve defects

Judging from the reports the clinical evidence shows only one case (7) in which as a result of nerve flap operation there was distinct return of function and one case (18) in which there was some improvement Hashimoto's report unfortunately is incomplete and does not admit of a proper critical survey In the other Case 7 in which there was a definite return the gap bridged was less than the distance Notta Heuter Langen

beck Horsley and others have shown may be overcome without surgical assistance. Nevertheless, it can not be said in this case that the neuraves grew into the distal segment without passing through the nerve flaps. On the other hand it can not be claimed that such downgrowth did take place through them.

Perhaps this answer may be found in a study of those cases in which the distance to be bridged was greater than may generally be overcome by spontaneous downgrowth. In *no* such case was there *convincing* evidence that as a result of the nerve flap operation any real improvement was established. A return frequently within a few days or weeks has been reported in muscles which were *assumed* judging from the site of the lesion to have been paralyzed. Such early return has been shown even for primary suture in which there is essentially no distance to be bridged by the neuraves to be incorrect and to be based on either incomplete examination or fallacious deductions. Thus the very date with which return of function is attributed were there no other evidence would in itself suggest that the nerves to these muscles had not been severed and that in them no paralysis had existed viz Cases 1 and 19.

A distinction must be made between the level of the lesion of the nerve trunk and the level at which nerve branches leave the trunk. There branches may follow a separate course and supply at a higher level than the injury, muscles whose action is below the point of severance of the nerve trunk and whose nerve supply is presumed therefore to have been severed. For example the nerve to the hamstrings to all purpose is not a branch of the sciatic. It is a separate and distinct nerve in close proximity to the sciatic supplying the hamstrings both by an upper and lower set of branches. The upper set is rarely severed. Thus through the semitendinosus some flexion of the leg on the thigh may be accomplished. The nerves to the gastrocnemius and soleus come off the internal popliteal well above these muscles and pursue a separate course supplying them with both an upper and lower set of branches. Other

examples might be given these suffice to emphasize the point that muscles can not be *assumed* paralyzed because of the level of the injury to the nerve trunk but must in each instance be demonstrated paralyzed. Neglect of this point has led to the erroneous conclusion that return of function has taken place and therefore reported successful.

Another even more common cause of error has been the acceptance of the performance of a total movement of the part as valid evidence of return of function. To be able to walk or write or otherwise move the hand or extremity does not affirm that nerve regeneration and restitution of conductivity has taken place. As has been pointed out many such movements may be accomplished by other muscles without the paralyzed muscles playing any role—*mobile supplee of Letié* *ant* Individual muscular action must be given both before operation as evidence of paralysis and after operation as proof of return of function. Mackenzie's case in particular does not offer in either paper conclusive evidence to substantiate his statement that there has been progressive regeneration on a colossal scale. As reported the motor sensory and trophic evidence tends to show that effective regeneration has *not* taken place.

Other errors of interpretation have occurred and have been responsible for failures so far as the nerve flap operation was concerned being classed as successful. The most striking example is Tillmann's case so long accepted as successful. It has been in a measure responsible for a continuation of this method of nerve suture. Had the case been studied more thoroughly it might have been shown that the essential improvement was not due to the nerve flap operation but to the liberation of tendons bound down into a tendinous knot.

More often the observation of these cases prior to reporting them has been over a period too short to admit of any final conclusions.

Judged purely from a clinical standpoint there is insufficient and inadequate data to warrant a continuation of the nerve flap method in the surgical repair of nerve defects.

On the experimental side no evidence has

been found in its favor. In none of the experiments were any regenerating neuraxes demonstrated within the nerve flap or the peripheral nerve segment.

The end sought by the formation of nerve flaps in bridging defects is to afford conducting paths to the downgrowing neuraxes. By the very mechanical arrangements of the flaps this end is practically annulled. The downgrowing neuraxes find little or no opportunity to enter the paths thus offered. In addition considerable damage is done the nerve either by removal of a portion of the trunk from which regeneration is to take place or by removal of branches to the muscles.

Thus from a study of clinical experimental and anatomical data the futility of bridging nerve defects by means of nerve flaps would seem to be definitely determined.

It is a particular pleasure to express my gratefulness to Dr Huber Director of the Anatomical Department in whose laboratory it has been my good fortune to work for reading the manuscript and the valuable suggestions and criticism he has kindly offered.

### CONCLUSIONS

1. The repair of nerve defects by means of nerve flaps has not been definitely supported clinically as evidenced by a critical study of the reported cases.

Experimentally it has been shown that nerve flaps do not serve as conducting paths for the downgrowing neuraxes.

2. Nerve flaps whether central or peripheral are merely degenerated partial nerve segments. Continuity and union of neuraxes does not take place at point of suture.

3. To avoid fallacious deductions it is important to distinguish between the level of the injury to the nerve trunk and the level at which muscular branches arise.

4. Abnormal communicating branches are not rare particularly between the median and ulnar. Such anomalies must be taken into consideration in any careful study of nerve injuries.

5. Judging from the level of the lesion muscles may not be presumed paralyzed but should be demonstrated paralyzed.

6. Total movements may not be offered as evidence of return of function. The action of individual muscles must be given.

7. Reports of peripheral nerve injuries to be of value must be accompanied by motor sensory and electrical findings.

8. By the formation of nerve flaps from the central stump a portion of the nerve from which neuraxes must grow is removed. Distal as well as central flaps may sever muscular branches. By reversing the flaps they are taken out of their field. Thus the downgrowing neuraxes are prevented from reaching the muscles through these muscular branches even were regeneration to take place.

9. The nerve flap method to bridge nerve defects should be discarded in peripheral nerve surgery.

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# DEPARTMENT OF TECHNIQUE

## METHODS OF CLOSING FACIAL FISTULÆ

B P LOCKHART MUMMERY FRCS (E G) LONDON E GLEND

S S ge M k H p l f D se l th R m L d S b gr Th Q H p l f Child L d  
C l S g l D l h B l C y l L l d f l m M l r y H p l

THE war has maimed our manhood in many dreadful ways but there are few more distressing cases than those of men left with facial fistulæ. They are unpleasant to themselves and their friends life is only tolerable with the constant attendance of a skilled nurse and many of them would sooner die than be condemned to live on in such a condition. Fortunately it is possible to cure these facial fistulæ but very skillful treatment is sometimes necessary and this is not always available. As many of these cases have sooner or later come under my observation either at St Mark's Hospital or at one of the military hospitals to which I have been attached it seems to me that it may be of service to record the experience that has been gained so that it may prove of assistance to others who have difficult cases of this nature to deal with. One fact has been only too obvious — that the right methods of operating upon facial fistulæ are not well understood for the great majority of cases had been previously unsuccessfully operated upon often several times. Not only had the attempts to close these fistulæ been failures but in most cases it was obvious that the method adopted had no chance of succeeding and was simply a useless and unnecessary operation. Many of the cases are extraordinarily complex and present quite exceptional difficulties so that a certain proportion of failures is to be expected but the number of patients with a history of repeated unsuccessful operations is much larger than it should be and this can only be due to the fact that many surgeons have failed to realize the difficulties that such cases involve or to find out the proper methods of dealing with them. As showing the great difficulties which such cases may present the two following are briefly recorded.

THE first case was a man who had been in the military hospital with a facial fistula for several years. The fistula was situated in the lower lip and was of the type known as a "beard" fistula. It was accompanied by a large swelling of the lower lip and by a constant discharge of pus. The patient had been treated by several surgeons but without success. The patient was brought to me by a friend and was found to be in good health otherwise. The examination showed a large swelling of the lower lip and a fistula opening in the lower lip. The fistula was of the type known as a "beard" fistula. It was accompanied by a large swelling of the lower lip and by a constant discharge of pus. The patient had been treated by several surgeons but without success. The patient was brought to me by a friend and was found to be in good health otherwise. The examination showed a large swelling of the lower lip and a fistula opening in the lower lip.

The second case was a man who had been in the military hospital with a facial fistula for several years. The fistula was situated in the lower lip and was of the type known as a "beard" fistula. It was accompanied by a large swelling of the lower lip and by a constant discharge of pus. The patient had been treated by several surgeons but without success. The patient was brought to me by a friend and was found to be in good health otherwise. The examination showed a large swelling of the lower lip and a fistula opening in the lower lip. The fistula was of the type known as a "beard" fistula. It was accompanied by a large swelling of the lower lip and by a constant discharge of pus. The patient had been treated by several surgeons but without success. The patient was brought to me by a friend and was found to be in good health otherwise. The examination showed a large swelling of the lower lip and a fistula opening in the lower lip.

We may classify facial fistulæ as follows

1. Temporary colostomies with a spur the operation having been performed at the casualty clearing station or at a base hospital for wounds of the rectum or colon.

Cases where mucous membrane is adherent to the skin. The opening may be quite small but more frequently is large and accompanied by extensive prolapse of the gut.

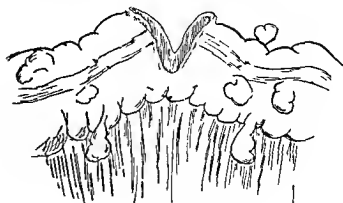
3 Cases in which a fibrous track or sinus connects the gut with the skin opening

4 Cases where the gut opens into an abscess cavity connecting with the surface

5 Cases of fæcal fistulæ complicated by compound fractures and hemorrhage

It is obvious that considering the great variety and complexity of the cases there can be no one operative technique which is applicable to all but that frequently some special method will be required to suit the circumstances of the case. Nevertheless there are certain principles which must always be observed if a good result is to be obtained. Fæcal fistulæ are generally complicated by considerable excoriation of the skin around the opening and in the case of cæcal or small gut fistulæ this is particularly severe. Before any operation is performed the skin must be brought in to as good a condition as possible or there will be little chance of success. For this purpose I administer opium in sufficient doses to cause a considerable degree of constipation and where possible the formation of solid stools. After a week or more if the case is carefully nursed and the skin protected by dressings of lanoline a very marked improvement will have taken place. Previous to operation the bowel is cleared by enemata and washouts administered through the fistula and aperients are not used.

One of the important points in operating is to open the abdominal cavity to one side of and well away from the fistulous opening. The exact method of doing this varies but the principle is the same — to get into the abdominal cavity and then with the parts well exposed completely to free the gut and fistula in one piece. The involved parts can then be drawn out of the abdomen and the exact anatomical condition ascertained. It is important to open up the abdominal cavity freely and get a good exposure of the parts involved. As much of the involved portion of the bowel is cut away as is considered necessary so as to leave quite healthy tissues which can be brought together to form the anastomosis or closure. Sometimes this will involve the complete resection of several inches of bowel but more frequently a large hole will be left in the bowel which only requires careful suture. It is a point of great importance that the blood supply to that part of the bowel wall which it is proposed to suture should be carefully preserved. I am convinced that most of the failures are due to this important factor having been neglected. The bowel should always be so cut that more of the bowel wall is cut away at the free side than at the mesenteric side even healthy bowel being removed if necessary. The cut edges



Dotted lines show lines of excision

of the bowel which are going to be joined should form roughly an angle of 45 degrees with the mesenteric border. This makes certain that the stitches joining the ends of the bowel on the mesenteric side do not cut off the blood supply to the joined edges on the free side (see diagram).

Lastly the hole in the bowel is sewed up the edges being brought together with catgut sutures passing through all the coats and this line of suture is reinforced with a second catgut suture through the peritoneal coat only. The abdominal wall is closed and a small drain preferably of rubber tissue is inserted down to the point of closure and brought out between two of the stitches. This drain can be removed in 36 hours. It is always advisable to have a drain as of necessity there must be some infection of the wound by bacillus coli. This infection seldom causes any trouble if a small drain is provided to enable blood effusion to escape but without such drainage abscess formation is liable to occur. The rubber tissue drain has many advantages over stiff tubes.

As regards after treatment my own practice is to insert a rectal tube at the time of operation and to irrigate very gently with water through this twice daily for the first two or three days. No pressure is used but the water is allowed to flow in and out again to wash the bowel and keep the tube clear. Liquid petroleum is given daily after the operation and small doses of magnesium sulphate each morning beginning the day after operation. The object of this is to obtain liquid stools daily. Since using these methods I have had no failure to close the fistula and very few cases in which immediate primary union has not taken place.

The following case will I think demonstrate the need for a better understanding of the necessary principles of success in these cases.

M S operated was operated on in January 1917 for appendicitis in a military hospital and as a result of this operation a fæcal fistula formed. It was again operated

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The most difficult cases to deal with are those in which there is a fibrous track between the skin and the opening in the bowel. Such cases are often the result of injury to the pelvic portion of the rectum. It is perfectly useless to attempt to close them by operating upon the skin opening. The only successful method is to open the abdomen well away from the fistula and get at the bowel end of the fistula. This must be cut out and the opening in the bowel closed. The fistula itself can either be cut out or if extensively involved in adhesions left to close of itself which it will soon do if disconnected from the bowel. In the case of fecal fistulæ discharging into an abscess cavity the abscess must be laid open and freely drained and the fistula operated on later.

Many of these cases of fecal fistulæ with a fibrous track between the bowel and the skin or face will heal without operation if the patient is kept constipated so that only solid stool passes the point of leakage and the fistula itself is left alone on no account should the fistula be plugged.

Fecal fistulæ involving the rectum and accompanied by extensive wounds of the sacrum or buttocks are generally treated at the Casualty Clearing Station by establishing a colostomy opening. If this has already been done the colostomy should on no account be closed until the rectal wound has healed up. I have met with cases in which this very obvious precaution has not been observed. If a colostomy has not been done the question of making one should be considered but if the wound is granulating satisfactorily in spite of the fecal discharge it is not always necessary to do a colostomy. If the wound in the rectum is small and the mucosa can be kept well away from the skin there is a good chance of healing without a temporary colostomy. To avoid pressure in the rectum which will tend to prevent healing of the wound a rubber tube should be kept in the anus or the phincter divided posteriorly. Rectal openings can always be made to heal provided the mucosa is not allowed to heal to the skin.

## A NEW SIGN OF FÆCAL IMPACTION

B. DP. RICARDO FINOLHIETTO. BORN 05 APR 5 1871

**P**ATHOGNOMONIC signs are very important but unfortunately they are very rare. In 1912 we noted a new sign of fecal impaction and as we have not found it in connection with any other abdominal tumor or pathological condition we are inclined to regard the sign as pathognomonic. Two signs of fecal impaction have been described but because we sometimes find misleading cases a third sign will be useful. The first sign is a depression that the palpating finger leaves if the impaction is a soft one. It is not of common incidence. The second sign is the Gersuny or Klebs symptom that is elicited by pressing upon the tumor then suddenly relieving the pressure. The sign is a feeling as if two wet surfaces were separated at the moment that the pressure is released.

The sign which we are about to describe is the auditory translation of the Gersuny sign. It is

elicited as follows. Over the chosen area the funnel shaped end of a French stethoscope is applied. Over the shell end firmly applied the observer ear holding the instrument lightly with the fingers. The abdominal wall is depressed a few (10 to 40) millimeters with the stethoscope and then the pressure is suddenly released. During the withdrawal of the stethoscope is heard a large moist rale if the sign is positive. Sometimes this is heard not only during the release of pressure but also during its application. Sometimes it is necessary to change frequently the place of the funnel in looking for this sign before it is found. Until the present time we have found the sign positive in every patient with fecal impaction. These crepitations are found much more easily than the Gersuny or Godet signs. If the crepitations persist after evacuation of the bowels it indicates that evacuation was not com-

plete Very often we have been able to find crepitations not only over the faecal tumor but elsewhere in the abdomen as well in places where there was no palpable tumor but where the X rays showed pathology as in the giant sigmoid the anatomical site of almost every faecal impaction The reason that we get crepitations in some places and in some others we do not is because the impacted faeces are of very different consistency the half hardened very sticky portions that are irregularly scattered throughout an impaction are most likely to give crepitations

The sign is very useful when without a previous history of constipation the tumor is small hard and slightly movable and the Gersuny sign is missing At some place in the abdomen we will find the crepitations of some sticky bit that is on the way to reach the impacted mass

The sign is also of use after evacuation of the bowels to enable one to judge as to the completeness of evacuation

We did not make an exhaustive research of the literature but we did not find this sign mentioned in the current textbooks

## FOREIGN BODY IN THE URINARY BLADDER

By B H CAPLES M D New York

Capt M d 1 C p USA USG radiol ptal N Y F t Ogl th r C g

IN the literature at hand there are no references to the method of treatment detailed below and this leads me to believe that a report of the following case will be of interest

Private J L age 21 admitted to Ward X urological service December 23 1918

His past history was negative except for urethritis probably gonorrheal in June 1917 He has had recurrent attacks of urethral discharge since that time

On December 20 thinking he was going to be examined for discharge from the Army he inserted a pencil of paraffin in his urethra in order to conceal a slight urethral discharge from which he was suffering at that time The pencil was made from a candle consisting largely of paraffin and measured approximately 5 centimeters in length and 7 millimeters in diameter During the day this passed into the bladder The following morning his urinations became frequent painful and bloody The symptoms increased in severity until he was admitted two days later to the urological service

His present complaint was the passage of bloody urine about every half hour pain at the end of urination sense of obstruction and occasionally inability to pass any urine whatever

Examination revealed normal external genitals On cystoscopic examination the paraffin corresponding in mass but differing somewhat in shape from the pencil could be seen plainly just within the vesical neck and firmly lodged at its upper margin *Diagnosis* Foreign body in bladder

*Treatment* Three attempts at interals of several days were made to remove the paraffin with a cystoscopic rongeur but owing to the location of the mass they were unsuccessful In the meantime having secured a candle of the same kind as the one he had used I cut from it a number of cubes each measuring 1 centimeter and placed one in each of a series of test tubes To them were added 5 cubic centimeter of zylene kerosene paraffin oil glycoline and also varying proportions of these solvents The tubes were then incubated at 37 C and from time to time a little urine added to each one The cubes in both the

gasoline and zylene were dissolved in 10 hours in kerosene in 11 hours in paraffin oil in 36 hours and in a solution of 33 1/3 per cent gasoline in paraffin oil in 12 hours As this latter solution could be held in the mouth for several minutes without irritation and as it was nearly as efficient as the others which were more or less irritant I decided to use it Through a retention catheter 1.5 cubic centimeters at 110 F was injected into the bladder This was easily tolerated and retained comfortably for one and a half hours After this injection the retention catheter was found to be no longer necessary Six subsequent injections each of 1.5 cubic centimeters and at 100 F were given These were retained for intervals varying from 2 to 5 hours The entire treatment covered a period of three days and the total time of exposure to the solvent was 17 hours The urine and solvent were collected after each injection and by chilling them the paraffin was precipitated in decreasing amounts down to the fifth specimen As the sixth and seventh gave no precipitate the injections were discontinued In the meantime the patient's symptoms abated rapidly and 10 days after his last injection his condition was normal One week later on cystoscopic examination the bladder was normal and no trace of paraffin could be found

The gasoline used in such cases should be of low grade about 55 degrees Baume scale (as thus volatilizes less rapidly than the higher grades) and may be sterilized by filtration with a Berkefeld filter in the absence of which it should be filtered through chamomile skin that has been thoroughly washed in hot water and soap lysol solution and distilled water It should then be exposed in a sterile glass container to the action of sunlight for several hours Sterile paraffin oil is on sale in original packages

I wish to acknowledge my indebtedness to Sergeant Poy Irumm of the department of pathology for his assistance

A METHOD OF TRACHEOTOMY WITHOUT LOSS OF BLOOD<sup>1</sup>

By DONALD GUTHRIE MD FACS SAYRE PENNSYLVANIA

Rbert P k H p i

**B**LOOD inspired into the trachea during the operation of tracheotomy is a frequent cause of pneumonia and death. An operation which is planned to prevent bleeding and yet does not take any longer to perform in the urgent case than the methods usually employed. I believe worthy of consideration and discussion.

Two operations for tracheotomy are used—the high and the low operation. The high operation is performed in the space between the cricoid cartilage and the isthmus of the thyroid gland; the low operation in the space below the isthmus of the thyroid and the sternal notch.

The high operation is the one in favor and advocated by most surgeons. Treves prefers the high operation because the muscles of the neck are distinctly separated, the main vessels of the neck, the inferior thyroid artery or an enlarged thymus are not encountered in this region, the anterior jugular veins are small and have very few transverse branches and the trachea is nearer the surface. Binnie says that should the isthmus of the thyroid be encountered in the high operation it may be loosened from the trachea by making short transverse incisions through the deep fascia and pulled downward. Bryant believed that division of the isthmus in children does not interfere with the future function of the thyroid and advised that the isthmus should be divided whenever it was found in the operative field. The isthmus of the normal thyroid lies over the third and fourth rings of the trachea. This gives a working space of but two rings below the cricoid cartilage if the isthmus is not to be injured in the high operation. (Fig. 1.)

From observations made at the time of goiter operations and from dissections giving an opportunity to study the anatomical relations of the structures above and below the isthmus of the thyroid gland I believe that the low operation of tracheotomy unless there should be enlargement of the thyroid is the more suitable for all cases, even the struggling child. My reasons for this opinion are the following:

The low operation is the better one to perform as a preliminary operation for laryngotomy, laryngectomy and for resection of the tongue because it gives a wider working field at the time of the secondary operation.

For foreign bodies in the trachea where the

services of an expert bronchoscopist cannot be had it is a better site to open the trachea because the foreign body will usually be found in one of the bronchi.

To refute the statement that the high operation is the one of choice in children I maintain that the isthmus of the thyroid gland cannot be divided without the loss of a large amount of blood and the loss of valuable time in some cases if this bleeding is to be controlled, also that the pyramidal lobe of the thyroid is encountered much more frequently than is generally supposed. The pyramidal lobe of the thyroid is extremely vascular as is well appreciated by those who operate upon the thyroid gland and it cannot be separated from the trachea without the loss of a large amount of blood and time.

I have studied the sternohyoid muscles repeatedly during goiter operations to see if the assertion that these muscles were separated in the region between the isthmus of the thyroid and the cricoid cartilage were true. I have never found them to be separated. The sternohyoid muscle is thin and can easily be separated in the low operation. I have also studied the anterior jugular veins and their communicating branches and apparently there is no difference in the size of these veins in the region of the high operation and the low operation. I have encountered communicating branches often but my observations have led me to believe that they are found more frequently above the isthmus than below it. If the anatomical relations of the superficial and deep veins below the thyroid are appreciated the trachea can be opened in the low operation with little or no loss of blood in most instances.

The anterior jugular vein extends downward from the chin upon the mylohyoid and sternohyoid muscles emptying into the external jugular or subclavian veins below the origin of the sternomastoid muscle. It anastomoses with adjacent veins and by a large arcus venosus just below the thyroid gland ( $\frac{1}{4}$  to  $\frac{1}{2}$  inches above the sternal notch with the vein from the opposite side). It is this large arcus venosus—or communicating branch between the anterior jugular veins—which must not be injured in the operation of low tracheotomy. (Figs. 2 and 3.)

Lying deeply in the median region of the neck behind the sternohyoid and sternothyroid mus-

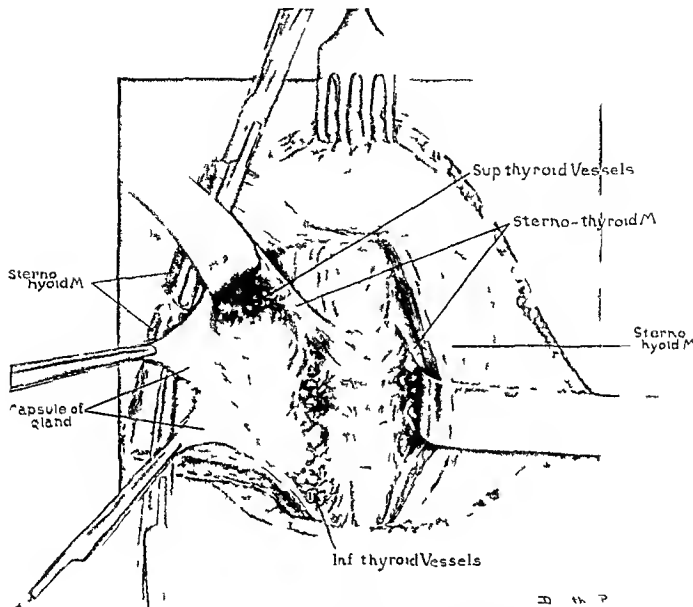


Fig 1. Anatomical relations of the trachea seen after tracheotomy showing a better working space below the isthmus of the thyroid than above

cles and at the lower margin of the isthmus of the thyroid gland is an unpaired venous network formed from the inferior thyroid veins the unpaired thyroid venous plexus (plexus thyroideus impar) which gradually empties into an unpaired vessel vena thyroidea ima descending in front of the trachea and emptying into the left innominate vein behind the manubrium of the sternum (Fig 4)

In addition there is also a pair of lateral inferior thyroid veins which collect blood from the lower portions of the lateral lobes of the thyroid gland anastomosing with preceding vessels the right vein opens at the angle of junction of the innominate veins or into the right innominate or into the

right internal jugular or into the right subclavian The left vein empties into the left innominate These veins lie laterally to the trachea and are not encountered in low tracheotomy (Fig 5)

The blood from the lower poles of the thyroid is collected by three unpaired venous branches The vena thyroidea ima lies in the mid line directly over the trachea It must be recognized and pulled aside by retractors before the trachea is opened (Fig 5)

To describe the operation briefly we shall consider three different types of tracheotomy

1 The preliminary operation in which the patient can be anesthetized and a careful dissection carried out



Fig 2 F t t p i thy d t my h g the  
l t f th a j gul

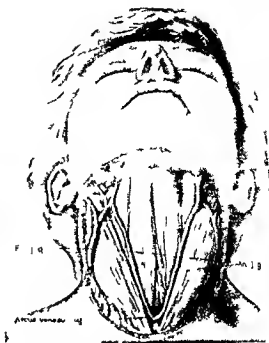


Fig 3 F t t p i thy d t my h g the  
l t f th a j gul

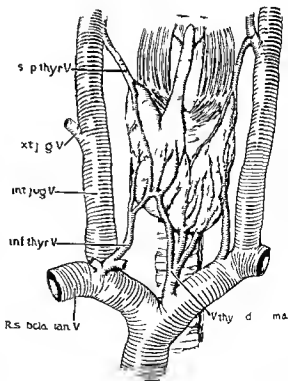


Fig 4 S p t f th t hy d d t thy d  
m scles h l t n f f thyr d e pl  
d thy d m n t a h

Fig 5 D g m m t d f t h th latu f  
the l t l f thyr d pl thyr d mp  
d thy d m

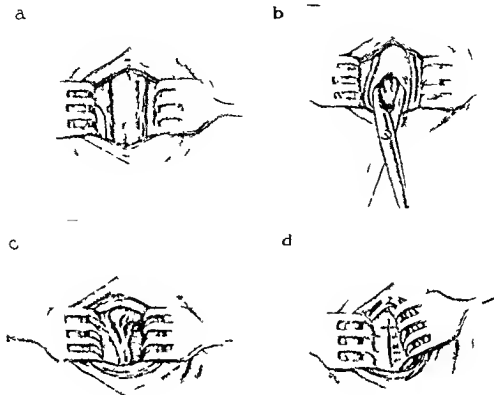


Fig. 6. Step of the operation of low tracheotomy

2 In the pulling patient who needs tracheotomy and not intubation or in whom intubation has failed to relieve the obstruction. Time can be taken to operate on these patients under local anesthesia.

3 The extreme case on the point of asphyxiation who is struggling and fighting for breath and who must be operated upon without anesthesia.

In the first and second type little or no blood need be lost if the relation of the veins is appreciated. In the third type if the thyroid ima can be pulled aside successfully no blood need be lost.

If the patient is a child it is wrapped in a blanket or sheet to control its struggling and placed upon the operating table or on a table in the home. A pad of some sort is put under the shoulders and the head is hung over the end of the table—steadied by an assistant. The operator stands on the right hand side of the table and steadying the skin with the left hand makes an incision in the mid line of the neck  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches long.

DaCosta gives the distance between the manubrium and cricoid in an adult as  $2\frac{3}{4}$  inches in a child of ten  $\frac{1}{4}$  inches and in a child of six

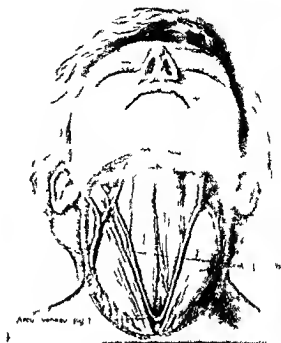
about inches. The incision should not extend down to the sternal notch but must end one half inch above it to avoid the arcus of the anterior jugular veins. The skin and the superficial fascia are incised and the wound held open by a pair of cat-snip retractors which should not be more than 1 inch in breadth. The parallel branches of the anterior jugular veins escape injury if the incision is made in the mid line of the neck because they lie to either side of it. The sternohyoid and sternothyroid muscles are separated by blunt dissection. If care can be exercised during this step of the operation the muscles can usually be separated without injury to the thyroid ima beneath. The retractors are reset. The left blade holds aside the skin, the first and the two muscles; the right blade holds the skin, fascia, the muscles and the thyroid ima vein. This exposes the trachea. It is incised the head is straightened and the tracheotomy tube inserted (Fig. 6).

This method has been employed fourteen times in all types of cases by myself and associates twelve times in the hospital twice in the home. We are convinced that it is one of value.





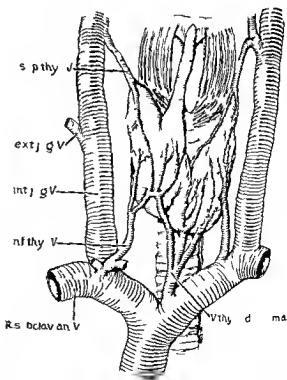
F J t l t l n t h f t r l jug l



F J l t t p n thyr d t my h g th  
r lat n f th j g l



F g 4 s p t f th t r n h y d d t th y d  
muscl h g e l t f f th y d n pl u  
d th y de m t h



F g 5 D g m m a t d w g t th l t n f  
th l t th yro l n s pl th y d m p a r  
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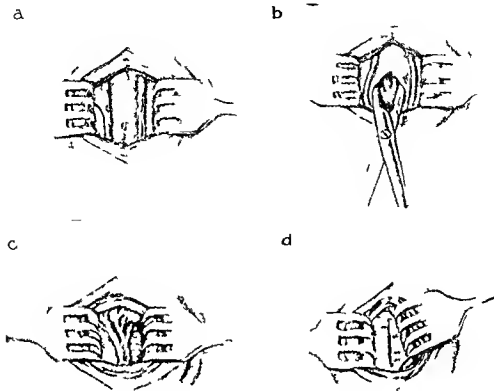


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This method has been employed fourteen times in all types of cases by myself and associates twelve times in the hospital twice in the home We are convinced that it is one of value

THE ETIOLOGY AND TREATMENT OF CYSTOCELE<sup>1</sup>

BY J. CRAIG WFFL, M.D., SAN FRANCISCO

SO much has already been written upon perineal lacerations and their sequelae that one is inclined to apologize for further communications. However some observations made during the past year may be of interest to the members of this society.

While uterine prolapse may occur in nulliparous women, extensive anterior vaginal relaxation with prolapse of the bladder is almost invariably due to injuries associated with childbirth.

From a study of the anatomical preparation of prolapse described by Halban and Tandler Dickinson has noted four planes of cleavage: (1) postpubic near the symphysis pubis, (2) urethrovaginal septum just below the urethra, (3) rectovaginal septum behind the vagina and (4) areorectal.

This classification is based upon pathological conditions and emphasizes the absurdity of trying to make one operation meet the many forms of prolapse. Cystocele occurs with a displacement of the first or second segment with or without disturbance of the other plane of cleavage.

The pelvic basin is imperfect in its bony boundaries and is completed to a large extent by muscle and fascia. The pelvic fascia is a direct continuation of the abdominal fascia and has its origin at the white line, the back of the symphysis and the pubic ramus. According to Cunningham the white line extends between the back of the pubis and the spine of the ischium and roughly indicates the line of separation of the pelvic cavity from the ischio-rectal fossa. It gives origin to fibers of the levator ani muscle and also to a secondary sheet of fascia known as the visceral pelvic fascia which arches downward and inward across the floor of the pelvis to be connected with the pelvic viscera. This membrane is thin and unimportant behind as it passes forward from the lower sacral vertebra to the rectum. It is thicker at the sides and front of the pelvis where it forms a stout membrane concave upward continuous medially with the fibrous coats of the rectum and the bladder and envelopes the prostate gland and seminal vesicle in the male and the cervix and vagina in the female. At the front of the pelvis this layer extends from the back of the pubis to which it is directly attached to the neck of the bladder and prostate gland in the male and to the neck of the bladder and cervix in the female.

This fascia is found to be quite dense sur-



Fig. T. n. th. u. h. l. g. i. m.  
d. f. c. j. t. b. l. d. l. l. d. d. t. th.  
R. d. b. f. h. c. l. f. M. l. l. C. r. o. n. a. d. A. l. A. b. s. f. t. h. p. e. p. b. l. b. e. d. t. h. C. l. f. S. t.  
J. l. Ap. l. p.

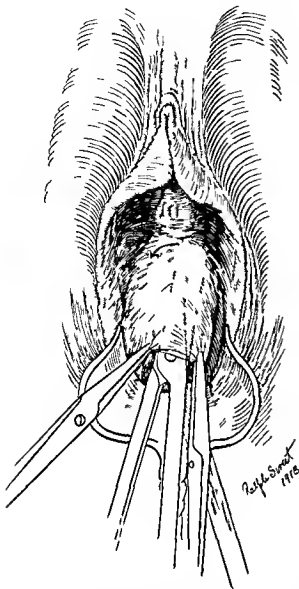


Fig. 2. Drawing showing the method of dissecting the bladder from the anterior vaginal fascia. Incision should be made on clamps and the points of incision elevated to avoid puncture of the bladder.

rounding the cervix and prolongations from it form the cardinal or Mackenrodt and the uterosacral ligaments the true supporting structures of the cervix.

While the urachus (ligamentum umbilicale medium) and the peritoneal folds limit the lateral movements of the bladder their attachments do not allow any suspensory function whatever. Therefore one must conclude that the true support for the bladder is the endopelvic fascia and when this support is weakened sufficiently a true hernia results.

The importance of having the bladder emptied to allow the head to enter the pelvis

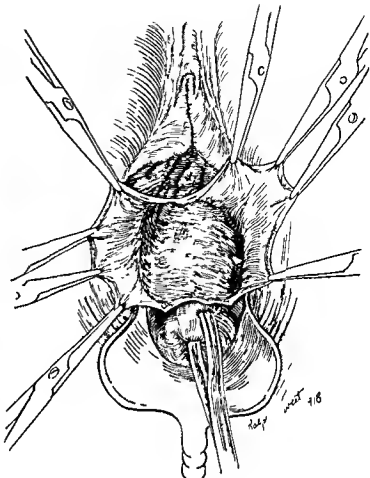


Fig. 3. Median incision of fascia and mucosa exposing the muscle wall of the bladder.

has long since been recognized. The neglect of this procedure not only prolongs labor but allows strong pressure to be put upon the anterior vaginal wall and thus by overstretching the fibers decreases the efficiency of the fascial diaphragm. Hence the bladder should be kept empty during delivery and overdistention prevented during the puerperium to allow the pelvic structures to regain their normal tone. Anterior tears and cervical lacerations involving the fascia should be repaired immediately.

The giving way of the pelvic fascia allows the bladder to descend forming what is generally spoken of as a cystocele. Clinically a prolapse of the bladder may occur (1) alone (2) with a prolapse of the urethra (3) with a prolapse of the uterus partial or complete (4) with a rectocele or (5) where all these conditions are present in the same patient. Hence the importance of various operations

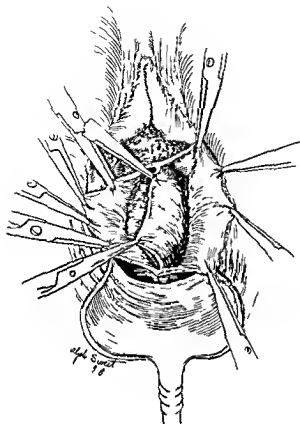


Fig 4 Dr g h g i t i f a b l y r f o m t h m

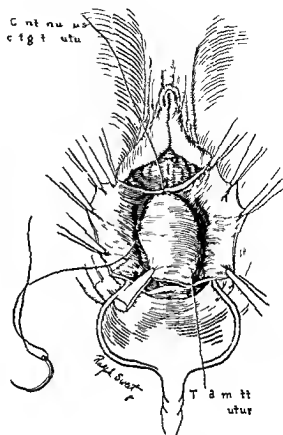


Fig 5 D h m t l f l p p g t f a l l p

depending upon the pathologic conditions can be readily seen. It is the purpose of this paper to present the treatment of a simple cystocele since the operations so far devised have given very unsatisfactory results. In a subsequent paper I hope to take up the consideration of the treatment of the other conditions.

In the first place it is important to consider a cystocele as a hernia and a cure can only be hoped for when the function of true supporting structures is restored.

#### TECHNIQUE

The cervix is drawn down and a deep transverse incision is made just below the bladder wall through the vaginal mucosa and the underlying fascia (Fig 1). The proximal flap is caught by forceps, care being taken to include the fascia with a pair of blunt scissors, preferably the Mayo type. The dissection

is carried between the muscle wall of the bladder and the fascia to the urethra (Fig 1). A median incision is then made; the bladder is dissected free of the cervix and the fascia and displaced upward to its normal position (Fig 2). The section is carried out by a small piece of gauze over the finger, the preurethral bladder. The fascial and mucosal edges are then caught separately by clamps and the separation begun by sharp dissection, care being taken to locate the proper layer in order to preserve the entire fascia. By blunt dissection the separation is carried well up to the pubic bones on either side (Fig 4). The remaining steps of the operation are identical to those employed in the treatment of hernia. The two flaps of fascia are overlapped by mattress sutures of No. 6 chromic catgut which are placed as close as possible to the pubic bones (Fig 5). The excess mucosa is then excised.

and the cut edges approximated with a running suture of catgut

This operation was first performed by me in July 1916. Since that time I have employed it in all cases where a cystocele was present and there has not been even the slightest tendency toward a recurrence in a single case. It was

my privilege recently to see a delivery at term in a patient upon whom I had done this operation one and one half years previously. Labor was not delayed, the bladder did not appear in sight during the entire delivery and there was no tearing of the anterior vaginal wall.

## AN IMPROVED METHOD FOR STERILIZING CATGUT SUTURES

By CASSIUS H. WATSON, B.Sc., M.D., BROOKLYN

THE usual commercial methods of sterilizing catgut sutures have always been susceptible of improvement. If absolute sterility of the sutures were the only consideration it would be a simple matter to apply such physical agents as heat or heat plus disinfecting solutions. It must be remembered, however, that catgut easily suffers deterioration and that methods of sterilization wholly suitable and proper when applied to more stable material quickly rob catgut of those properties which are essential for their surgical integrity. In addition to sterility, sutures must possess a maximum tensile strength, utmost flexibility and the desired degree of absorbability. Furthermore the medium in which the sutures are immersed as well as the sterilizing process must be such that the sutures suffer no physical damage during or after sterilization and come to the surgeon's hands with all these characters preserved to the highest possible degree.

Realizing the faults of the current methods an attempt has been made to devise a process of sterilization which would not only insure absolute sterility but which would also cause no impairment to the other properties of the suture material. The only logical way in which sterility can be obtained and maintained throughout the process of preparation is to sterilize the sutures in their ultimate storing fluid after sealing the tubes. The perfection of such a method constituted the problem studied.

The efficiency of all sterilizing methods is dependent to a considerable degree upon the nature of the storing fluid employed. Such substances as chloroform and alcohol ordinarily used in commercial practice are unsatisfactory on account of their low boiling point, their hardening action on the gut and in the case of

chloroform the tendency to decompose into objectionable products causing deterioration of the sutures and imparting to them an irritating action. Rogers<sup>1</sup> had recommended toluol as a storing fluid and inasmuch as a long series of personal tests has confirmed his opinion and thoroughly demonstrated the advantages of this hydrocarbon over chloroform and alcohol it was decided to employ toluol exclusively in these experiments. The factors to be determined then were the degree of heat to be employed and the duration of the exposure of the sutures to this heat. Not only was the effect of the method on the physical properties tested but careful bacteriological experiments were carried out with the various sizes and kinds of catgut sutures in order to determine the actual killing power of the method upon different types of unusually resistant bacteria. The details of the experiments were as follows:

Five foot strands of Numbers 00 and 4 plain and 20 day chromic catgut sutures were made into coils and tied to prevent unrolling, then immersed for four hours in heavy sporulating broth cultures of—

1. *Bacillus mesentericus*
2. *Bacillus anthracis*
3. *Bacillus tetani*

The strands were thus thoroughly and massively infected. The coils were then dehydrated over calcium chloride and sulphuric acid in a vacuum tubed in the regular way, the tubes filled with toluol and then submitted to a heat of 165° C. for five hours. In carrying out the bacteriological tests the outside of the tube was disinfected by immersing in corrosive sublimate solution. The

R E S A L L T I L d v a t g e s c h l f r m d i h l  
t a l l u r g i c a l t g A S g 19 6 N l p p 3 3  
3 6

tubes were then broken the suture removed with sterile forceps washed in 75 cubic centimeters of sterile distilled water in order to remove the toluol and then placed in tubes containing 15 cubic centimeters sterile nutrient broth. In the case of the sutures infected with tetanus bacilli the strands were planted in freshly boiled 1 per cent nutrient agar containing 0.5 per cent dextrose cooled to 40° C. The tubes were then incubated for two weeks at 37° C and frequently examined for growth. The experiment was controlled by—

1. Transplanting into fresh broth 0.1 cubic centimeter of the broth culture used in infecting the sutures.

2. Planting two sutures of each size of each kind after infection and drying in order to prove that the sutures contained viable organisms immediately before being subjected to the sterilizing process.

3. By inoculating with the respective organisms the broth or agar containing the infected and sterilized strands when no growth appeared after incubation.

This last control was done in order to demonstrate that the nutrient medium employed was capable of growing any of the three organisms which might have survived the sterilizing process and also that not enough toluol had been carried over with the strands to exert any inhibiting action.

*E. coli* m. f. S. pa. t. l. f. t. i. b. th.  
(b. l. l. it. f.) d. b. l. m. t. ulg. t.  
(b. l. l. ulg. t.) p. t. ly. d. b. t. d. t. l. h. y.  
g. o. w. t. h. p. t. Th. l. u. e. th. l. d. t.  
m. t. m. p. e. t. f. th. l. d. t. f. p. r. u. l.  
t. St. d. s. m. h. o. d. a. b. d. f. p. o. r. u. l. t. g.  
f. m. n. d. f. p. o. S. b. l. t. r. f. g. d. b. t. h.  
h. d. l. a. t. g. th. E. g. t. f. f. t. d. f.  
h. e. f. a. h. k. d. f. t. w. m. m. d. m. h.  
cult. th. n. d. d. t. b. d. d. t. r. d. z. e. d. l. a. d. y.  
de. r. i. b. e. d. Th. b. t. r. i. l. g. l. a. m. t. f. th. i.  
y. l. d. t. h. f. l. w. g. l. t.  
N. f. t. h. t. b. t. g. th. t. b. j. d. t.  
th. t. l. h. g. p. o. h. d. y. g. w. h. Th. t.  
l. l. a. p. l. y. d. d. t. l. e.  
C. t. l. H. a. y. g. o. w. t. h. f. b. l. m. t. r. n.  
C. t. o. l. H. e. a. y. g. w. t. h. o. f. b. c. l. l. m. t. r. n.  
C. t. l. 3. H. y. g. w. t. h. o. f. b. c. l. l. m. s. t. r. n.  
E. p. f. N. t. t. b. r. th. l. t. l. th.

p. l. l. f. l. l. th. d. c. b. t. d. t. l. a.  
h. y. g. th. a. p. t. th. n. d. l. t. e. d. w. i. t. h. s. o. t. s. a. l. t.  
l. t. d. p. l. d. t. r. o. o. m. t. e. m. p. e. r. a. t. u. r. e. n. d. t. f. a. r.  
l. l. a. t. S. i. e. d. m. e. a. r. s. h. d. n. b. d. t. f. a. r.  
p. o. l. t. u. n. g. f. m. d. f. p. o. Th. m. u. m. b. i.  
l. s. f. p. e. m. n. t. i. w. e. t. a. t. d. a. b. o. d. b. e. d.  
R. H. N. f. i. h. t. u. b. s. c. o. t. g. t. h. s. t. r. e. s. b.  
j. t. d. t. th. t. u. g. p. o. c. e. h. w. d. n. y. g. r. th. Th.  
t. l. l. p. p. n. t. l. y. d. e. r. e. d. t. e. n. l.  
C. t. l. H. y. g. th. f. b. l. l. th.  
C. t. l. H. y. g. th. f. b. c. l. l. n. t. h. c.  
C. t. l. 3. H. y. g. th. f. b. l. l. s. a. t. h.  
E. p. f. i. h. l. y. t. r. u. d. d. c. o. o. l. d. b. t. h.  
l. l. h. d. p. l. y. f. l. b. o. l. n. o. c. u. l. t. e. d. w. i. t. h.  
l. l. h. f. b. c. l. l. t. i. d. l. l. d. t. r. m. m.  
th. b. a. t. 37.5. C. n. t. l. t. h. h. y. e. d. u. m. t. b. d.  
p. t. d. s. f. p. o. r. u. l. t. g. f. o. r. m. s. d. f. e. p. o. Th.  
t. t. d. i. h. t. t. e. d. l. d. y. d. b. e. d.  
K. H. N. f. i. h. t. b. y. c. t. d. i. t. h. t. r. u. l. u. n. g.  
f. h. d. y. g. r. th. Th. t. l. l. p.  
C. t. l. d. d. t. d. f.  
C. t. l. H. y. g. th. f. b. l. l. t. t.  
C. t. l. l. l. a. y. g. th. f. b. c. l. l. t. e. t.  
C. t. l. 3. l. l. y. g. th. f. b. l. l. t. t. t. h. g. a.  
f. m. t.

#### DISCUSSION

In the three experiments described above representative sizes of catgut sutures corresponding to those usually employed in surgical practice were heavily infected with three different species of sporulating bacilli thus producing a more massive and resistant bacterial infection of the gut than would occur even under the most unfavorable condition. With toluol as a tubic or storing medium the sutures were subjected to a temperature of 165° C for five hours after the tubes had been sealed. The sutures were removed from the tubes and tested for the presence of living bacilli by appropriate bacteriologic method. The fact that none of the suture after having undergone this sterilizing process showed the presence of any viable organisms would seem to prove the complete efficiency of this method of sterilization. Careful physical tests not detailed here showed no change in the tensile strength, flexibility or absorbability of the sutures. The method of sterilization as described would therefore appear to possess marked advantages over the usual methods in that it insures absolute sterility without in any way affecting the desirable physical properties of the suture material.

# Clinical Congress American College of Surgeons

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NINTH ANNUAL MEETING  
NEW YORK CITY  
OCTOBER 20 TO 24 1919



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GEORGE D STEWART  
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ALFRED S TAYLOR  
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PERCY R TURNURE  
H H TYSON  
ANTOINE P VOISLANSKY  
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# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

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## THE CLINICAL CONGRESS IN NEW YORK CITY

FOR the Ninth Annual Session of the Clinical Congress of the American College of Surgeons to be held in New York City October 20th to 24th 1919 the plans contemplate a clinical meeting to be conducted along the general lines of previous sessions but one that in point of scientific interest will surpass all previous meetings. Considering the large group of surgeons interested the numerous large hospitals laboratories and medical schools the great wealth of clinical material available a five day program of surpassing interest may be confidently expected. The morning and afternoon hours of each day will be devoted to operative clinics and demonstrations with scientific meetings each evening at which papers dealing with surgical subjects of present day importance will be read and discussed by eminent American and European surgeons especially invited because of wide experience in treating the conditions under consideration.

The postponement of the meeting planned for last year was unavoidable due to the extraordinary influenza epidemic. In general the plans for that meeting have been carried over for this year's session except that at this meeting emphasis will be laid upon those surgical problems which are of greatest importance in civil practice at this time.

The Committee on Arrangements composed of leading clinicians of New York City and Brooklyn are preparing a schedule of clinics and demonstrations which will fully represent the clinical activities of that great medical center. All departments of surgery are to be represented including gynecology obstetrics urology orthopedics surgery of the eye ear nose throat and

mouth roentgenology experimental surgery surgical pathology etc. A preliminary schedule of these clinics and demonstrations will be published in the next issue of this journal but the real program of the Congress is that bulletined each afternoon at headquarters which gives in detail the cases to be operated upon and demonstrated in the several clinics on the succeeding day. Clinical demonstrations before large groups of men in some conveniently located amphitheater or hall will be held each afternoon when surgical problems will be discussed and cases exhibited. In these demonstrations some of the visiting surgeons especially selected because of their experience will participate.

### LIMITED ATTENDANCE—ADVANCE REGISTRATION

The popularity of these clinical meetings has proven so great that it has been found necessary in recent years to adopt the plan of limiting the attendance and requiring advance registration. A survey of the operating amphitheaters lecture rooms and laboratories in the hospitals and medical schools as to their capacity for accommodating visiting surgeons has been made and the limit of attendance based thereon. Visiting surgeons are thus assured that there will be accommodations at the clinics for all who receive cards.

The total of registrations received at this date indicates that the limit of attendance will be reached in advance of the opening of the session. Available accommodations will not permit the acceptance of all applications for registration which will be disappointing to many surgeons who have attended previous meetings. When the limit of attendance has been reached through advance

registration no further registrations will be accepted

To each surgeon registering in advance a formal receipt for the registration fee is issued which receipt is exchangeable for a general admission card at headquarters upon his arrival. This card which is non transferable must be presented to secure clinic tickets and admission to the evening meetings. Headquarters at the Waldorf Astoria will be open for registration on Sunday October 19th for the convenience of members arriving in the city on that day. The clinical program for Monday will be bulletined at headquarters on Sunday and tickets for Monday's clinics will be issued as visiting surgeons register.

#### CLINIC TICKETS

Attendance at all clinics and demonstrations is controlled by means of special clinic tickets the number of tickets issued for any clinic or demonstration being limited to the capacity of the room in which the clinic or demonstration is to be given. As a general rule one may have two tickets for each day one for a morning and one for an afternoon clinic but for certain clinics where the accommodations are limited and the demand for tickets is heavy the rule will be that a visitor may have but one ticket for such clinic during the week. The use of clinic tickets has proven an efficient means of providing for the distribution of visitors among the several clinics and insures against overcrowding.

Clinic tickets will be issued at headquarters each morning at 8 o'clock for the clinics and demonstrations to be given that day a complete schedule of the day's clinics having been posted

on the bulletin boards on the afternoon of the preceding day. After the program has been posted reservations for clinic tickets for the next day's clinics may be filed the tickets to be issued the next morning. Printed programs will be issued each morning containing the complete clinical program with announcements of the evening session business meetings etc.

#### REGISTRATION FEE

A registration fee is required of each surgeon attending the annual clinical meeting the receipts from registration fees providing the funds with which to meet the expenses of preparation and conducting such meetings so that no financial burden is imposed upon the members of the profession in the city entertaining the Congress.

#### HEADQUARTERS

General headquarters for the Congress will be at the Waldorf Astoria Hotel where the Grand Ballroom Astor Gallery Myrtle and East Rooms together with other large public rooms and foyers have been reserved for the use of the Congress for its registration and ticket bureau bulletin rooms etc. The Grand Ballroom will be used for the general sessions afternoon and evening. The Hotel McAlpin with its large number of guest rooms under the same management as the Waldorf Astoria and located in the same block will be able to take care of a very large number of the visiting surgeons. There are many other first class hotels in the immediate vicinity but because New York hotels are usually well filled in October it is urged that surgeons who expect to attend the Congress make early reservation of hotel accommodations.



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# SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE PUBLISHED MONTHLY

VOLUME XXX

OCTOBER 1910

NUMBER 4

## INTENTIONAL REMOVAL OF SKIN AND OTHER TISSUES OVERLYING DEEP SEATED INOPERABLE CANCER A NECESSITY FOR EFFECTIVE TREATMENT WITH X RAY OR RADIUM

WITH REPORT OF RELATIVE ABSORPTION OF RAYS BY SKIN FAT AND MUSCLE  
AS COMPARED WITH VARIOUS THICKNESSES OF ALUMINUM

By EMIL G. BECK, M.D., F.A.C.S., CHICAGO

AND

G. W. WARNER, A.B., CHICAGO

Of the Ry. & T. Co. of Ill. Chicago, Ill.

### SUGGESTION FOR TREATMENT

WHEN confronted with a recurrent carcinoma of the breast or neck for instance the surgeon is apt to be too pessimistic in regard to the possibility of helping the patient. Usually the patient is referred to a roentgenologist for radium or X ray treatment partly to satisfy the hopes of the patient who in his despair is happy to believe that something more can be done for him and partly because we do not yet know definitely the possibilities of radium and X ray therapy. We hesitate to do anything further surgically because we feel that if the surgeon was not able to eradicate all of the cancerous growth at the first operation a second operation is apt to be much more difficult and not likely to be as radical as the first one. While recurrent cancer is not a promising field for the surgeon still it seems to me that we have not yet exhausted all of our efforts in combating this dreadful foe. I have come to the conclusion that even in apparently hopeless cases something more can be done and I have endeavored to work out a method of meeting this problem.

It is a well known fact that superficial malignant growths such as epithelioma respond readily to X ray and radium treatment while deep seated malignant growths do not. The reason for this is very suggestive. The skin and subcutaneous tissues which usually overlie deep seated cancer are strong filters for the penetration of the X rays. They absorb most of the soft rays from the X ray tube and allow only the hard rays which is a small quantity to penetrate deeply enough to reach the growth. Small quantities of radiation instead of destroying the cancer cell are apt to stimulate it to more rapid growth. Therefore it has seemed to me that if the skin and all the overlying tissue and as much of the growth as is feasible is removed and a large area left entirely exposed and to this field is then applied either the X ray or radium directly we may obtain similar results in treating deep seated carcinoma as are usually obtained in treating superficial growths. In other words our problem is to convert the deep seated growth into a superficial one.





Fig Sh t t f t t m t  
| | t t \ y d d m t m t

1) During the past two years I have subjected a series of cases to this form of treatment and while it is too early to form definite conclusions I desire to report the findings and results thus far obtained

#### PHYSICAL PROPERTIES OF RADIATION

The physicists teach us that three varieties of rays emanate from radium the  $\alpha$  ray  $\beta$  ray and  $\gamma$  ray. The  $\alpha$  rays constitute 91 per cent of all the rays emanated from radium the  $\beta$  rays about 7 per cent the remainder  $\gamma$  rays only about 2 per cent. The  $\gamma$  rays are very readily absorbed by metal foil or even by the air. Rutherford says that a thickness of 6/1000 aluminum or mica or even a sheet of ordinary writing paper is sufficient to absorb completely all the  $\alpha$  rays. Almost all of the  $\beta$  rays are absorbed in 5 millimeters of aluminum or 1 millimeter of lead. Only the  $\gamma$  ray will penetrate these filters. The density of tissues depends upon the close packing of the molecules which compose them. In fat for instance the molecules are far apart while in the skin or muscles they are more closely packed and in metal such as lead or silver the molecules are extremely dense. The shadow on the photographic plate of these different substances give us an approximate indication of the molecular composition. Lead will produce a very dense shadow while fat or muscle will give a corresponding lighter shadow.

For a rough working rule it may be taken that the thickness of matter required to absorb any type of rays is inversely proportional to the density of the substance. Thus the  $\alpha$  rays have very little effect in the treatment of either superficial or deep seated growth. The  $\beta$  rays however are about one hundred times as penetrating as the  $\alpha$  ray and the  $\gamma$  rays are from ten to one hundred times more penetrating than the  $\beta$  ray. Therefore it is evident that the  $\alpha$  ray may be entirely ignored as far as the treatment of cancer is concerned. We must depend entirely upon the action of the  $\beta$  and  $\gamma$  rays. Are we at present utilizing them to their full extent? We are not. The skin being the densest of all structures of

To verify the above hypothesis I began to use this technique in selected cases. I started with a very simple method. Instead of closing the wound after the completion of the operation for cancer of the breast I allowed the skin edges to retract as much as possible in order to leave an opening through which the  $\gamma$  ray and the radium treatment might subsequently be allowed to penetrate directly into the cancer bed and destroy any cancer cell which were inaccessible to surgical removal. I am aware that this has been done by others previously but I have carried the principle further. I have selected recurrent apparently inoperable cases of deep seated carcinoma such as cases of cancer of the axillary and suprascapular glands subsequent to removal of the breast and in the selected cases I have removed intentionally large areas of skin fat fascia and muscles and as much of the carcinoma as is consistent with the safety of the operation. The entire area was left exposed for the application of either  $\gamma$  ray or radium treatment (see Fig

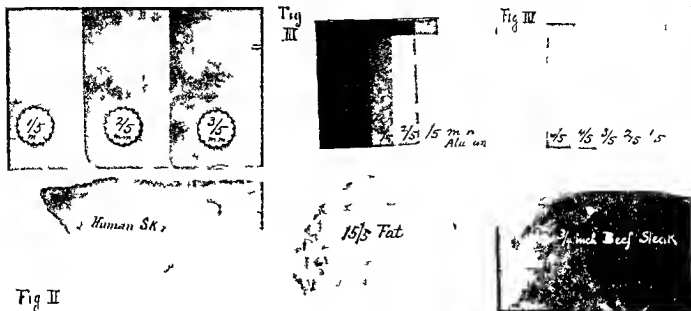


Fig 2 3 4 Compare the density of shadows produced by different thicknesses of aluminum with that of certain thicknesses of tissues namely skin fat and muscle

the body is itself quite an obstacle to the penetration of the X rays it produces a shadow on the X ray plate equal to that of three fifths of a millimeter of aluminum because of the arrest of the rays by the skin and where the underlying tissues such as muscle fat and fascia absorb still more of the rays it is likely that very few of the rays ever reach the deep seated tumor. Thus we deprive ourselves of the action of the greater quantity of the most effective rays emanating from the radium namely the  $\alpha$  rays. Even the  $\gamma$  rays lose some of their intensity in passing through the skin and subcutaneous tissues.

To determine just how much of the X ray is absorbed by the skin fat and muscle we have two methods at our disposal one is the photographic method and the other the electroscopic. The following experiments have been undertaken by me to determine the quantity of X ray absorbed by the tissues.

**First** A piece of skin free of fat removed from the knee of a young man was placed on an X ray plate and beside the skin were placed three strips of aluminum of different thicknesses one fifth two fifths and three fifths of a millimeter respectively. Comparing the shadows produced upon the plate by the aluminum and that of the skin we can approximately estimate the relative amount of

rays absorbed by the skin (see Fig 2). It appears that the skin absorbs about as much as does three fifths of a millimeter in thickness of aluminum which is considered by roentgenologists a substantial filter for the rays.

**Second** A layer of fat one half inch in thickness was placed along a series of five aluminum filters ranging from one fifth of a millimeter to 1 millimeter in thickness. A roentgenogram for comparison of these two substances was made in a way similar to that in the case of the skin experiment and it was shown that one half inch of fat would arrest on the average about as much of the rays as two fifths of a millimeter of aluminum would filter (Fig 3).

**Third** The same experiment as for fat was made with muscle tissue. A piece of beefsteak three quarters of an inch in thickness was placed alongside the filter scale and the shadow produced by the beefsteak was at least three times as dense as that obtained from 1 millimeter of aluminum (Fig 4). Thus it would appear that three quarters of an inch of muscle would be capable of absorbing all the  $\beta$  rays from radium.

The measurements of the absorption of rays by means of the electroscop are more accurate and are now being conducted by G

W. Warner A. B. at the Ryerson Laboratory of the University of Chicago. The report of his work is here appended. His experiments show that our photographic measurements are approximately correct, namely that a great portion of the harder rays are absorbed by the skin and muscle.

#### REPORT OF CASES

Taking into consideration the physical characteristics of the ray, I have concluded that in order to have a full measure of the effective X-rays reach the tumor we must remove the obstruction to their passage, namely, skin muscle and as much of the tumor as possible. The procedure will be best understood by the demonstration of cases because the operation must of necessity be different in each case. For illustration I shall cite several cases from a larger series in which this treatment has been tried. We must bear in mind that we are attempting the almost impossible and cannot expect that a magic cure will follow in miraculous fashion. If we can improve only in a small degree upon previous methods we are taking a step in the right direction which may finally lead to fruitful result.

The method is based on scientific principle and while the number of cases thus far treated is not sufficiently large to draw definite conclusions, the ultimate are encouraging, notwithstanding the hopelessness of the case to justify its application. The patients are usually perfectly willing to undergo one more operation because they have lost all hope of getting well.

What becomes of the large denuded surface after the growth has apparently disappeared. The skin will gradually grow from

the edge of the wound until it covers the entire surface. The growth of epithelium is accelerated by the aid of adhesive plaster. The growth of skin over the cancer area is proof in itself that the cancerous tissue has been eliminated because healthy epithelial cells will not grow over cancer tissue. I have observed in the cases I have treated that skin will grow over large surface which formerly contained masses of cancerous tissue. Whether there will be metastatic tumors in other parts of the body following this treatment is an undecided question. It is likely that there will be. The susceptibility to cancer recurrence in what is called a cancer individual may still remain even though the growth in a particular region be destroyed. It has been stated by some observer that subsequent to the X-ray treatment changes take place in the entire body and these changes immunize the patient against recurrence. This is too extensive a question to be discussed in this paper.

The following case will serve as illustration of this method of treatment.

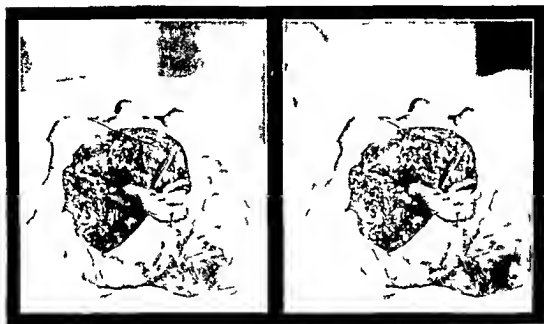
CASE I. Robert, a male of the best family, was born in 1865 and died in August 1906 of cancer of the stomach. The tumor was removed. The microscopic examination of the tumor showed it to be a carcinoma. The patient died in August 1906.

In addition to the entire and a denuded area of the left upper extremity for the purpose of treatment under the X-ray. The treatment was continued for three months. The tumor was removed. The patient died in August 1906.

The patient died in August 1906. The tumor was removed. The patient died in August 1906.



Stereophotograph B Recurrent carcinoma of submaxillary gland



Stereophotograph C Recurrent carcinoma of middle ear and neck



Stereophotograph D Recurrent carcinoma of submaxillary gland





Fig 1

Fig 1. Recurrent carcinoma of the breast in the supraclavicular region. Edema of arm.



Fig 13

Fig 13. Removal of skin, fat, muscle, and supraclavicular region of recurrent wound left open for treatment.



Fig 14

Fig 14. Five month later wound entirely closed with skin. Patient gained 50 pounds, perfect motion in arm. No recurrence up to date.

was eliminated. The skin flap was then pushed underneath the inner ramus of the jaw and kept there by gauze packing. This left the wound entirely exposed (Plate I).

Into the depth of this wound 10 milligrams of radium element was inserted for 4 hours. This was repeated every week, besides the daily exposure of the wound to the X-ray. The patient began to gain in weight rapidly—20 pounds to date. The skin began to grow into the wound by the aid of adhesive plaster and now, more than a year later, the patient is in perfect health without a sign of recurrence (Plate II).

We have done even more extensive operations upon three other cases of recurrent carcinoma of the jaw or the submaxillary gland, but it is still too early to make a report as to the therapeutic results. At present I will simply include photographs to illustrate to what extent we should go in removing the overlying tissues in cases of this kind. A final report of the entire series of cases will be made when sufficient time has elapsed to permit us to judge more or less the therapeutic effects of this treatment.

Stereophotographs B, C, and D show the extent of the removal of skin, fat, muscle, and glandular structures and as much of the tumor as feasible. A short history and description of the operation is found in the legends for the illustrations.

Another illustration of the extent to which we may proceed in resecting recurrent carcinoma in the inguinal region is shown in the colored Lumiere stereophotograph A.

In this case there was a most extensive involvement of the inguinal glands, the lower part of the abdominal muscles and the gland beneath Poupart's ligament, subsequent to a primary carcinoma of the scrotum. The deep vessels were involved also. All the tissues overlying the tumor and as much of the tumor including Poupart's ligament as possible were removed in January, 1910, and the large surface shown in the picture left for subsequent radium and X-ray treatment. Rapid improvement followed first and the tumor mass has almost disappeared so that patient was able to travel to Detroit to be presented before the Western Roentgen Ray Society. Later metastatic tumors appeared in the right inguinal region, which were excised early enough to prevent involvement of the deeper structures. Unfortunately the patient had a severe hemorrhage from an erosion of the femoral vein on the left side, the first involved, which caused sudden death.

The subject is here treated mainly from the standpoint of the surgeon and not from that of the roentgenologist. Thus the points in the technique of the application of the X-rays, etc., are omitted. This important part of the work is being worked out by Dr. Paul E. Roentgenologist at the North Chicago Hospital, who has treated all of my cases and who will in due time publish his observations as well as those I have had in the application of radium.

The roentgenologist is handicapped when such cases are referred to him for treatment, for the surgeon has closed for him the door to success by suturing the wound over the area to be treated. When the surgeon realizes

that the full exposure of the cancer bed is necessary to avoid recurrence he will disregard the cosmetic effect and prepare the field for efficient roentgen treatment

I present this subject in this immature

state merely that others may try it and help perfect the surgical as well as the roentgen technique. It certainly can do little harm to these poor individual who have nothing but misery and death to look forward to

## RELATIVE ABSORPTION OF RAYS BY SKIN, FAT AND MUSCLE AS COMPARED WITH VARIOUS THICKNESSES OF ALUMINUM

B. C. W. WARNER, M.D.

A HYDROGEN tube with tungsten target was used excitation being produced by a transformer and rotary rectifier (Victor). The absorption was measured by an ionization method. The distances of 16 and 32 inches refer to the distance from the target to the window of the ionization chamber. The numbers are percentages of the total incident rays absorbed by one aluminum screen

or absorbed approximately 5 per cent of all the rays falling upon it in the conditions given in Table I. The aluminum screens were of standard type but varied from 0.20 to 0.40 millimeters in thickness. Since the time of exposure was of necessity very short and because the effects from equal short interval of time are not equal due to the variations in the primary current no attempt was made to keep the time interval constant but in general it was somewhat longer for the 32 inch distance than for the 16 inch distance.

In Table I two sets of data were taken for the 16 inch distance for each absorbing substance. A comparison of these results shows that the percentage of variation in all cases is less than 1. Comparing the results for the two distances shows that for short distances there is practically no difference in the percentage of absorption hence in the remainder of the work the 32 inch distance was used.

In Table II the same absorbing substances were used as in Table I but with the addition of three other substances. The heterogeneous rays were obtained with the same conditions as before except that the voltage and consequently the current through the tube were increased slightly. The medium hard rays were obtained by screening out the soft rays by interposing a piece of plate glass between the tube and the ionization chamber.

The great variation in the two samples of skin is easily accounted for by the fact that the first sample was much thicker and of more uniform thickness than the second.

| X-Ray | Al   | Al   | Al   | H    | Fat   | M     |
|-------|------|------|------|------|-------|-------|
| Al    | 1/5" | 2/5" | 3/5" | SK   | 15 mm | 40 mm |
| 10/   |      |      |      |      |       |       |
| 20/   |      |      |      |      |       |       |
| 30/   |      |      |      |      |       |       |
| 40/   |      |      |      |      |       |       |
| 50/   |      |      |      |      |       |       |
| 60/   |      |      | 48   | 49.5 |       |       |
| 70/   |      |      |      |      |       |       |
| 80/   |      |      |      |      |       |       |
| 90/   |      |      |      |      |       |       |
| 100   |      |      |      |      |       |       |

Ch t i Ab pt f \ r s by k f t d  
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TABLE I

[illegible]

TABLE II

[illegible]

The slight increase in percentage absorption with increased voltage would at first seem to indicate that the absorption is greater for hard rays than for soft ones but since

when all the soft rays are screened out by interposing the plate glass the percentage absorption is cut down approximately half the explanation is no doubt that while in creased voltage did produce some harder rays it also produced a proportionally greater number of soft rays thus increasing the per centage absorption for the heterogeneous beam The very great decrease in percentage absorption for the harder rays seems to be a plain indication that the fleshy tissues are quite transparent to hard rays

It is usually unwise to attempt to draw a conclusion from incomplete data but it seems safe in this case to predict that a few centimeters of body tissues would act effectively as a screen for nearly all the soft rays but would be quite transparent to hard rays. Hence if it be the soft rays that are valuable in therapeutics the removal of parts overlying the diseased organ is quite essential but if hard rays are the valuable ones then removal of the overlying tissues seems unnecessary.

Chart I illustrates the comparative figures of ray absorption by various tissues.



# CUTTING THE SENSORY ROOT OF THE GASSERIAN GANGLION FOR THE RELIEF OF TRIFACIAL NEURALGIA

By A. W. ADSON, M.D., I. I. T. R. M.  
F. m. ch. 15 N. I. G. M. C.

THE treatment of trifacial neuralgia has varied from the use of simple counter irritants to the most radical procedure namely, ganglionectomy. The method now employed is injection of alcohol into the peripheral branches of the ganglion division of the peripheral brain and the division of the posterior root known as the physiologic extirpation of the ganglion.

The disease has no known etiology. Sir Victor Horsley has stated that trifacial neuralgia is possibly caused by dental infection resulting in a ascending neuritis. This however has been objected to by numerous physicians on the ground that if the condition were ascending neuritis there would be a definite anesthesia as well as motor paralysis in the branches involved. Frazier states that its etiology may be sclerotic lesion of the ganglion while Dana ascribes the probable cause to degenerative changes in the ganglion and nerve which lead to neuritis. These suggestions are at least hint toward solving the problem of the etiology.

Patrick in his reviews has given an excellent resume of the symptomatology of trifacial neuralgia. He calls attention to the fact that the disease is about equally divided among both sexes that there is only one type that it usually occurs in middle life or after but that it may occur in very young persons. He reports a case in which the symptoms began when the patient was 4 years and three cases in which the patient was 75 years. Patrick's deduction are practically as follows. There are no predisposing factors and while some patients are neuritic others are not. The disease is not hereditary although there are cases on record in which several members of the same family were afflicted. The neuralgic attacks in the infra-orbital division first in the order of frequency then the mandibular and lastly the ophthalmic. I am experienced by

patients is described as shooting stabbing jabbing stinging darting and zigzag burning of the face. It is as a rule of short duration and not a continuous dull aching type that is usually brought on by irritation such as eating or drinking of hot or cold food and liquids, talking exposure to sudden drafts or washing of the face and teeth. The patient complains of certain areas of the face the trigger zones being more sensitive than other parts of the face. Patrick also states that the disease is generally a chronic one that he has seen no spontaneous cure that quiescent periods may last from 4 to 6 months that some have no bearing on the causation of the attacks and that during the attacks pain is usually quiescent at night. The condition has a definite symptomatology and does not imitate migraine nor pain that comes from sinus infection or dental causes. The true case of trifacial neuralgia has never been relieved by sinus drainage nor by the removal of teeth.

The first radical treatment was administered for the condition by Roe in April 1890 when he removed the gasserian ganglion but on account of the serious bleeding and the complication that developed he was compelled to abandon the procedure. In 1895 Hutchinsonson advised a partial resection of the ganglion. He removed two thirds of the ganglion and resected the second and third branches saving the ophthalmic. His preference for this operation was on the ground that it is not so serious as a complete ganglionectomy that it does not produce any the less of the evil thus avoiding conjunctivitis and trophic interstitial keratitis. The operation is best attended with considerable bleeding and does not offer any relief for neuralgia of the ophthalmic branch. Little and Verger in 1900 and Schloffer in 1903 described method of injecting the peripheral branches of the fifth nerve with alcohol for

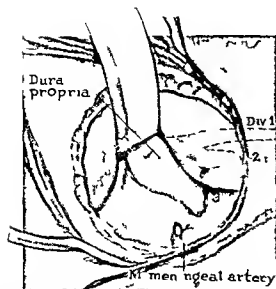


Fig. 3 Exposure of the third branch of the right trigeminal nerve in Gasserian ganglion and ligated middle meningeal artery

when the posterior root is cut and not avulsed. No seventh nerve paralysis occurred in 6 successive cases from January to August 1919 since this change was made in the technique.

Budge's experimental work on dogs shows that the pupils of the eye will contract when the branches of the trigeminal nerve are divided peripheral to the ganglion but will only slightly contract when divided proximal to it.

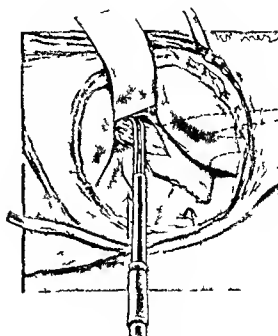


Fig. 4 Posterior root brought into view after the division of the dura propria preparatory to cutting the posterior fibers

Bernard found that the pupil contracted and later dilated after the division of the trigeminal but never attained the same size as the pupil on the other side. These phenomena occur after central division as well as after peripheral division of the fifth nerve.

Spiller says it is probable that sympathetic fibers pass to the eye after entering the trigeminal nerve through the Gasserian ganglion and as in the division of the sensory root they

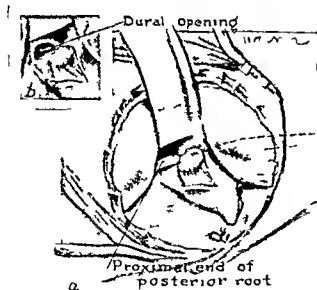


Fig. 5 a Cut of the posterior root of the Gasserian ganglion b Dural foramen over petrous portion of temporal bone through which the posterior fibers of the posterior root have dropped into the posterior fossa

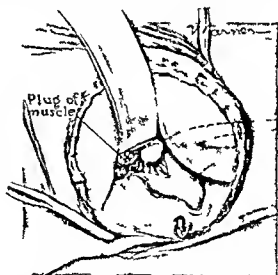


Fig. 6 Inserting pledget of muscle into dural foramen between severed ends of the posterior root

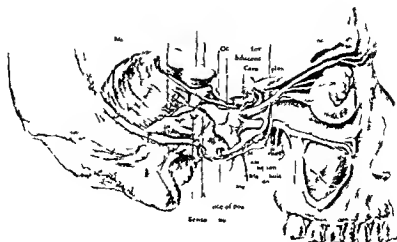


Fig. The right side of the head and neck, showing the facial nerve (CN VII) and its branches. The diagram illustrates the relationship between the nerve, the ear, and the jaw. Labels include 'M', 'OC', 'L', 'C', 'S', 'P', 'N', 'V', 'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I', 'J', 'K', 'L', 'M', 'N', 'O', 'P', 'Q', 'R', 'S', 'T', 'U', 'V', 'W', 'X', 'Y', 'Z'.

The frontal branch of the seventh nerve was frequently injured in making the Hartley-Krause incision but it is rarely injured in the incision described by Frazier which is within the hair line.

In operating in 10 cases of trifacial neuralgia in 1917 and in 8 cases in 1918 at the Mayo Clinic two complications have attended the technique suggested by Frazier and Spiller: the occasional paralysis of the seventh nerve and the trophic interstitial keratitis. When seventh nerve palsy occurs it is accompanied by a lagophthalmos which in turn permits undue exposure and dryness of the corner resulting in abrasions and the formation of trophic ulcer. Interstitial keratitis may occur independently of paralysis of the seventh nerve; it is very troublesome and may result in the formation of an opaque corner. If the complications could be avoided in the technique the operation could be recommended without any hesitancy to patients suffering with trifacial neuralgia.

In an investigation of the probable factors involved in the causation of seventh nerve palsy it was found (Hutchinson) that the seventh nerve paralysis might occur as the result of detachment of the dura from the petrous bone thus allowing the blood to enter into the small openings leading into the aque-

duct of Fallopius when the paralysis occurs it occurs immediately. It may be only slight at first but it becomes complete within a day or two as in one of our patients. It was present immediately after the operation progressed until complete and then subsided very slowly during 6 months. The condition was also attended with trophic interstitial keratitis. A notation was made at the time of operation to the effect that the dura had been stripped along the ridge of the petrous bone. I have had four patients with a seventh nerve paralysis however in whom the dura was not stripped from the petrous bone. The technique employed was that suggested by Frazier and Spiller in which the root was raised with a blunt hook. All of the 6 patients were free from facial palsy until after the fifth day when it came on gradually became complete remained for about 6 weeks and then gradually disappeared. I am unable to say definitely just what the causal factors were but on avulsing the ganglion roots at postmortem considerable trauma in the pons at the point of exit of the posterior root of the ganglion was noted. It seems probable that the cause of occasional seventh nerve paralysis is trauma resulting in small hemorrhages and edema of the pons and of the brain stem. This is further verified by the results obtained

turned down over the ganglion while the proximal fibers are pushed back into the posterior fossa. A small pledget of muscle is inserted into the dural foramen as a plug. This assists in making a barrier between the severed ends and prevents the extensive loss of cerebrospinal fluid that usually follows when the patient recovers from the anesthetic. If there is any danger of bleeding it is well to insert a narrow strip of iodoform gauze and remove it on the third day. The muscle and fascia are closed with interrupted sutures of chromic catgut No 1. The skin is closed with interrupted sutures of silk which are removed on the fifth day. During the operation the eyelid is closed with adhesive which is replaced by a Buller's shield before the patient leaves the operating room. The shield is worn for a week or ten days and subsequently is exchanged for close fitting auto mobile goggles to be used whenever the patient is exposed to wind or dust. In addition to wearing goggles we advise irrigations twice daily with 1 per cent boric acid solution.

The principles of the physiologic extirpation of the ganglion laid down by Spiller and Frazier have been carried out in the foregoing technique except that the posterior root has been exposed without injury to the ganglion and particularly the cells supplying the ophthalmic branch thus decreasing the frequency of trophic interstitial keratitis and the posterior root is cut instead of avulsed in this manner avoiding the occasional seventh nerve paralysis.

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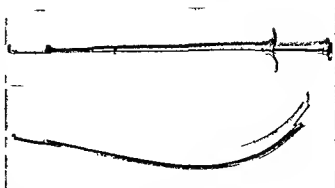
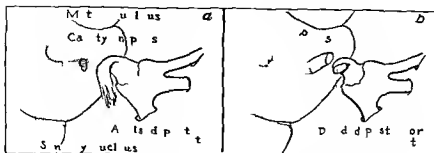


Fig. 8 (above) Cullottine knife

Fig. 9 Ganglion retractor

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F a l d t t h t u m i d u e d t h t h f b y t b D  
n f t h p t c t b y c t t t h t t l m a o f t h j n

are not injured the danger of ocular disturbance by this operation is lessened. The trophic influence of the gasarian ganglion on the eye may possibly depend on the integrity of the sympathetic fibers.

In our observation it was found that whenever trophic interstitial keratitis occurred one of two things happened at the time of operation either the dura propria had been split so that the ganglion was greatly exposed or it was necessary to insert a large pack to control bleeding thus causing pressure on the ganglion. It is noted also that if only the posterior margin and root were exposed there was never any immediate keratitis. From experimental work it is evident that sympathetic fibers from the carotid plexus in dogs pass through the ganglion into the ophthalmic branch. It is difficult to state just what communications take place in man but the pupillary phenomenon as seen in dogs does not occur in man. I believe however that sympathetic fibers play an important part in the trophic supply of the cornea or that this function is controlled by the ganglion cell of the ophthalmic division which if not injured during the operation will protect the cornea against ordinary irritations. The ganglion cells or sympathetic fibers remain uninjured if the dura is not elevated over the ganglion.

#### OPERATION

The patient is placed in a semi-erect position with the head on a special headrest which may be raised or lowered to the position desired. A general anesthetic is used. The anterior limb of the question mark incision

over the temporal region and down in front of the ear to the zygoma be in centimeter posterior to the external angle of the orbit and 3 centimeters above a line drawn parallel with the zygoma. The skin flap is turned forward and the fascial flap covering the temporal muscle is turned backward both being carried down to the zygoma. The temporal muscle is split and the skull exposed by a mastoid retractor. A subtemporal decompression is done and an area of bone about 3 centimeter by centimeters is removed. The dura is gently elevated from the middle fossa until the meningeal artery which we prefer to ligate is exposed. The foramen is plugged with bone wax followed by further elevation of the dura until the posterior margin of the third branch appears. Dissection is then carried posteriorly and inward exposing only the posterior margin of the ganglion. The dura propria is not opened until the region of the posterior root is reached thus injury of the ganglion is avoided particularly of the inner portion the cells controlling the ophthalmic branch. Before the dura propria is opened over the posterior root all bleeding is controlled. The dura covering the brain is held under gentle tension and the cavity is well illuminated by means of the ganglion retractor. After the dura has been opened the fibers of the posterior root are gently exposed and slightly elevated and the cellulose knife is slipped over the fiber which are to be cut thus avoiding any trauma of the posterior brain stem. The aversive innervation is rarely injured inasmuch as all of the anatomical marks may be seen clearly. The fiber of the posterior root just above the ganglion are

recurrence. But local recurrence after the proper complete excision of a primary carcinoma of the lower lip is unusual in the hands of good surgeons.

However when we excise a piece of the mucous membrane with the submucous glands for a benign tumor of the mucous membrane or a benign cyst of the submucous glands a little keloid growth is not an infrequent sequel. Associated with the induration in the scar there is always the sensation of tension and discomfort and the swelling of the lip in and about the scar varies. This change in the size of the palpable area is characteristic. The patients are always apprehensive that the condition is malignant and as a rule their mental discomfort is greater than the local

CASE 1 Pathological No. 1640, Mr. R. W. Observed in October 1914. Well April 1919 four and one half years.

This patient was a white male, aged 38. When I saw him in October 1914 there was an indurated scar on the mucous membrane of the right side of the lower lip extending from the mucocutaneous border down to within 1 centimeter of the gum. About one year ago he observed a white patch on the mucous membrane in the area of the present scar. This apparently was a patch of leucoplakia. After it had been present 5 months it was removed with some caustic. There formed almost immediately in this scar an area of induration which was painful and the swelling of the lip varied in size. It had been present then about 6 months. Although I felt that the condition was benign I had no way of ascertaining the nature of the original local lesion except from the history. On October 2, 1914, under novocaine I excised the scar with an area of normal mucous membrane but did not cut through the skin. The microscopic study of this tissue showed no evidence of carcinoma but a granulation tissue tumor somewhat like an ordinary keloid.

Figure 1 (low power) shows a bit of hypertrophied mucous membrane, the cellular scar tissue and the scar tissue surrounding the mucous glands. Figure 3 (high power) shows only the scar tissue tumor. Figure 3 (high power) shows that the tumor is composed largely of spindle cells and fibroblasts but there is a number of different types of round cells, many of them of endothelial type and remains of what appeared to be degenerated acini of mucous glands.

Although the wound healed by first intention the induration in the scar immediately reformed. The patient complained of intense discomfort and was very apprehensive. Not knowing as much about these scar tissue tu-



FIG. 1. Case 1 Pathol. No. 16407. Scar tissue tumor of mucous membrane of lower lip. Low power photomicrograph of section of tissue removed at second operation. Hypertrophied epidermis, cellular scar tissue, mucous glands surrounded and invaded by granulation tissue.

mors as I do now. I was persuaded to operate again in about one month—November 17, 1914.

At this time I excised a V shaped piece of the entire thickness of the lower lip, hoping that this would prevent the recurrence of the keloid. The wound healed by first intention. Serial sections showed the same pathological picture as did the tissue of the first operation. Again the induration and discomfort appeared. Figures 4 and 5 illustrate the external appearance of the lower lip and the typical scar on the mucous membrane. February 1915, 3 months after the second and last operation. On the whole the induration was less than before my first operation and perhaps the discomfort was less. By this time I had convinced the patient that he did not have a malignant disease and that ultimately his discomfort would disappear. I saw him at rather frequent intervals. For one year there was little if any change in either the induration or in the discomfort. By June 1916, 1 year and 8 months after the second operation, there began a definite change for the better. There were periods in which there was little or no sensation of discomfort and the attacks in which the lip would swell were becoming less frequent. By 1917, almost three years, the patient admitted for the first time that he was apparently well and he ceased his visits to be assured. In February 1919 this patient writes that in the past year he has observed swelling of the scar and pain on but two occasions. With the exception of these two attacks he has

## SCAR TISSUE TUMORS OCCURRING ON THE MUCOUS MEMBRANE OF THE LOWER LIP

By JOSEPH COIT BLOODGOOD M.D. F.A.C.S. BALTIMORE

WE are all familiar with the ordinary keloid which may form in any scar whether the wound heal by first intention or by granulation. We know that this keloid is observed more frequently in the colored race and in children in the white race and is perhaps more frequent in females of the white race than in males.

Microscopically this keloid growth is composed largely of spindle cells and fibroblasts; very cellular areas are not conspicuous. It is covered with epidermis in which the papillary epithelial body is small and there are no hair follicles or glands. The thin epidermal covering of the subepidermal scar rarely ulcerates unless subjected to trauma. Then a chronic ulcer develops which is very slow in healing. In cases of this kind the microscopic section shows a surface of cellular granulation tissue. Although theoretically one would expect the development of sarcoma in such an area or carcinoma when there is an ulcer, I have observed neither in a long experience.

The life history of the keloid in scars is not unlike ossifying myositis. This also may be looked upon as a scar tissue tumor, the original wound being a laceration of muscle associated with hematoma and in the surrounding granulation tissue bone formation takes place. The intramuscular tumor reaches a certain size then remains quiescent then gradually partially or in some instances completely disappears. The majority of surgeons and pathologists are now familiar with the benign muscle lesion although formerly it was frequently explored under the diagnosis of sarcoma and in some cases amputation performed.

Other types of scar tumors or granulation tissue tumors will not be discussed in this article as I wish to call special attention to an infrequent type which my record show have usually been diagnosed clinically and often pathologically recurrent carcinoma both by the surgeon and pathologist.

This benign scar tissue tumor occurs on the mucous membrane of the lower lip. The patients give a history of the removal of a small mucous membrane or subepidermal tumor. The growth has been removed either with the knife or some caustic. In the majority of cases the tissue removed has not been studied microscopically. Now when an induration appears in the scar which has the feel of a recurrent carcinoma there is a second operation but the scar tissue tumor always recurs. Now if a diagnosis of carcinoma is made the indicated operation would be mutilating.

The clinical and pathological evidence which I have been able to collect since 1914 demonstrates that this is a keloid growth and the best results are obtained when it is left alone. These observations also emphasize the vital importance to the patient that these little apparently innocent primary tumors should not only be studied with the microscope but the original sections and tissues should be preserved because if the scar tissue tumor does develop the knowledge that the primary growth was benign allows one to be certain that the induration in the scar is not due to the local recurrence of a malignant tumor. When this evidence is not obtainable the diagnosis is much more difficult and in some cases the scar tumor must be excised for microscopic study.

When we consider the scar tissue tumors of the mucous membrane of the lower lip the following evidence based upon a large number of cases over a period of twenty-five years is helpful.

Primary carcinoma of the mucous membrane of the lower lip is rare. The position of onset of carcinoma of the lower lip is usually at the *mucocutaneous* border. When this local lesion is excised as a V-shaped piece of tissue and the wound closed I have never observed the keloid or scar tissue tumor which I am about to describe. If an induration appears in such a scar the probabilities are that it is a

recurrence. But local recurrence after the proper complete excision of a primary carcinoma of the lower lip is unusual in the hands of good surgeons.

However when we excise a piece of the mucous membrane with the submucous glands for a benign tumor of the mucous membrane or a benign cyst of the submucous glands a little keloid growth is not an infrequent sequel. Associated with the induration in the scar there is always the sensation of tension and discomfort and the swelling of the lip in and about the scar varies. This change in the size of the palpable area is characteristic. The patients are always apprehensive that the condition is malignant and as a rule their mental discomfort is greater than the local

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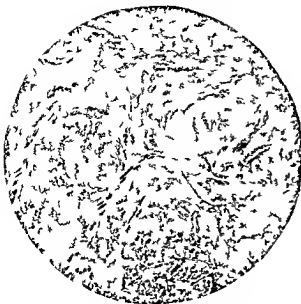


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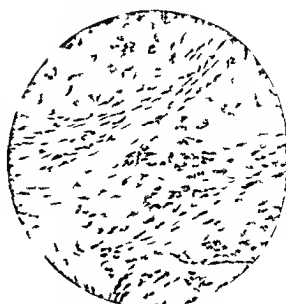


Fig 3 C P th l N 64 x II hpo ph to  
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A little unnatural sensation in the scar the scab external sensation has disappeared July 1919 external induration has disappeared

The patient was a smoker and apparently the original lesion was a leucoplakia due to smoking. However I have no evidence that the resultant scar and its pain had anything to do with the irritation due to the use of tobacco. The patient stopped smoking after my first operation in 1914 and did not resume for three years. The Wassermann blood reaction was negative. The patient was otherwise healthy. His teeth as shown in the photograph were in good condition. His local discomfort was real because there were periods in which he was free from the pains and sensations.

It does not seem helpful to the problems of diagnosis and treatment to take space for the discussion in detail of the character of the sensations in the scar in the mucous membrane of the lower lip.

It was the long and careful observation of this case that has helped me in the recognition and treatment of the patients who subsequently came under my observation.

CASE P tholo 11 N 280 D J McD  
Scar tissue tumor bser ed 1 April 1910 No oper  
ation Well April 1919 four years

This patient a white male aged 40 had had a small scab about 8 millimeters in diameter excised from the mucous membrane of the left side of the lip 6 weeks before I saw him in April 1915. At that time the scab rested on a small red area and was surrounded by an area of slight induration. The little lesion had been observed 3 months before the operation. The patient a smoker and the cause of the little ulcer on the mucous membrane of the lower lip may be explained by the projection of the tip of the scab of the upper lip.

The pathological report on the microscopic section from the small area removed as follows:

I find that a clipping of the epithelial cell into the deeper tissue here suggests the possibility of malignancy. It would seem advisable to remove some more tissue on one side here it is difficult to tell whether the tumor had been cut with a knife.

To exclude later 4 years ago on account of the epithelial tissue completely excised without cutting a skin. Nevertheless in the short space of time (6 weeks) between the first and second operation a definite induration in the scar had formed. Thus after 4 weeks since the second operation no clinical resembles that picture in Figure 4 (Case 1).

I telegraphed the laboratory in which the routine pathological diagnosis was made and asked the pathologist to both the section and the tissue had not been excised. The biopsy was removed at the same time as the tumor.

Therefore in this case there was no way of confirming by a re-study of the microscopic section the original diagnosis. Fortunately I

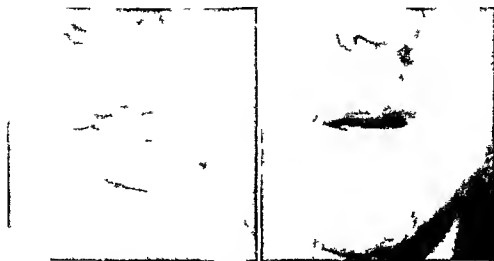


Fig. 4 a d 3. Case 1. Pathol. No. 6407. The appearance of the scar tissue tumor three months after the second and last operation. The microscopic appearance of the tissue removed at this operation is shown in Figures 1 and 3.

was familiar with a case of similar nature in which the microscopic study (Fig. 6) showed the dipping of the epithelium of the epidermis due to the pressure of a tooth and this patient has remained well 10 years after the excision of this tissue. In this case from the report of Dr. L. C. Ingram of Deland, Florida, who operated I could pretty certainly conclude that the lesion in the first instance was excised with a good margin and for this reason the patient was advised against a third operation. In April 1919, 4 years later this patient writes: "My lip has remained unchanged and has given me no trouble."

Here we have evidence that the scar tumor may remain for 4 years but give no discomfort.

**CASE 3.** Pathological No. 2007. Mrs. D. O. D. Extensive scar tissue tumor on lower lip first observed in August 1911. April 1919 almost 2 years still giving discomfort with attacks of intermittent swelling. July 1919 examination well no indication.

**Clinical history.** White female aged 31. Five months ago when the patient was cleaning her teeth a piece of mucous membrane was abraded and a little ulcer formed. Following the advice of her physician it was treated twice daily with iodine and the ulcer increased in size to that of a five-cent piece and at the ulcer edge a little wart formed. This area was treated by repeated excisions with the scissors curette and the application of silver nitrate.

One week before I saw the patient on August 10, 1911, the area had been excised and the wound closed. The following pathological report was sent to me: "Diagnosis: Carcinoma spinocellulare. Sections show hypertrophy of mucous membrane with island

of squamous cells free in the submucous tissue. Beneath one area of ulceration there are nests of atypical squamous cells invading the surrounding connective tissue."

Figure 7 shows the huge scar involving the mucous membrane of the lower lip with hypertrophy of



Fig. 7. Pathol. No. 9458. The microscopic appearance of the tumor. White male aged 13. Did not crack in the mucous membrane of the upper lip prior to a previous second incision. Slight ulceration in lip. Observed three months. The crease 6 millimeter long at the width of a hair. There is a history of duration about 1 year. Excised in 1909. Well 1919—ten years. The section shows that the epidermis has been pushed in and in some places the basal epithelium has disappeared and the transitional epithelium is present in the connective tissue.



I concluded from the history that the original tumor was either a cyst or an adenoma of the labial mucous glands and at that time (January 1918) I was sufficiently familiar with this lesion to advise against further operation.

The most common tumor on the mucous membrane of the lower lip is a cyst of the labial glands.

CASE 5 Pathological No 235. Scar tissue tumor on lower lip. History of two operations and radium treatment. Observed in August 1918. April 1919 much improved.

*Clinical note.* Mr B C Y. was referred to me by Dr Edwin L. Ellis, Maryville, Tennessee. The age of the patient was 37. There was first observed a submucous nodule the size of a pea on the mucous membrane of the lower lip. This was about 1 year ago. After it had been present 3 months it was removed with some kind of caustic. Within 4 months after this operation an indurated area formed in the scar which became painful. This area was excised by another surgeon 1 month before I saw the patient, then the patient received radium treatment.

I had the opportunity to examine the sections from the second operation. It resembled microscopically the cases already described and illustrated in this article. The Wassermann was negative and the blood count normal.



Fig. 9. Case 3. Pathol. No. 2007. Another view of a section from the same tissue as in Figure 8. This specimen is from the thickened mucous membrane, appearing normal to the cut. The section is horizontal and not vertically through the hypertrophied mucous membrane. The section is a false diagnosis of carcinoma.



Fig. 10. Case 3. Pathol. No. 2201. The appearance of the recurrent scar tissue tumor some months after the complete excision of a V-shaped piece of the lip with the lesion shown in Figure 9. The operation has improved the local condition.

It is my impression that the original tumor in this case was a cyst or an adenoma of the labial mucous glands. Any operation was advised against.

CASE 6 Pathological No. 23866. Scar tissue tumor of mucous membrane of the lower lip following the excision of a benign cyst. Recurrence after the excision of the scar. Third operation advised by an experienced surgeon. Observed in February 1919. Still under observation April 1919. August 1919 examination better.

*Clinical note.* Mr H C D. was first operated on in October 1918. Previous to this operation I elicited the following history: White male, age 48, smoker in August 1918, 3 months before operation and 4 months before my examination, the patient observed on the mucous membrane of the left side of the lower lip a small subcutaneous nodule which on one occasion ruptured and discharged mucus. The tumor however did not disappear. The lesion received treatment with nitrate of silver. This crustic produced an area of superficial ulceration so in addition to the primary nodule there was a little ulcer with a scab and an area of induration. The patient consulted a number of surgeons and dermatologists.

The tissue excised was examined by Dr J. Homer Wright of Boston whose report is as follows:

There is some hyperplasia of the epithelium and at one point there is a cleft in the mucosa which seems to communicate with what appears to be a dilated lymph channel or which might be in connection with the salivary gland duct near it. Such a duct



Fig. 1. (P. H. N. 3866) Ph. m. g. ph. l. p. h. g. th. h. l. t. h. d. a. d. h. g. l. m. mem. l. t. th. l. l. d. a. l. c. t. s. be. th. th. p. d. m.

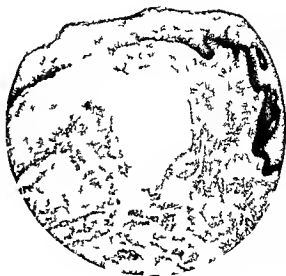


Fig. 2. (P. H. N. 3866) Ph. m. g. ph. l. p. h. g. th. h. l. t. h. d. a. d. h. g. l. m. mem. l. t. th. l. l. d. a. l. c. t. s. be. th. th. p. d. m.

a d saliva v gland t ue ar p nt in the ecti  
Th e i no d n of m lignan d a e

I am inclined to think Dr Wright means when he writes salivary glands one of the mucous glands of the lip and what he describe I have seen in similar cases in which I have removed the primary cyst of one of these labial glands

After the peation th u l heal d p a t l by granulation and an idurated ar a so m d n the scar

S d o p t i n D b i r g r s Th ope tion i r f o r m d by a n o t h r u g o n n a n i n t h e c t y Th s of the muc u s m b r a n a l u l muc u t s u a e d d i e o n c l d A l t h u g h t h e u d h e l l a r t t e n t o n t h e i n d u a t i o n n t h s a r r t r n d m e l t e l Th s u r g o l o p r i o r m d t l e s o j o p a l o a d v i d i l l i n p i e o f t h e f a c t t h a t t h e c p i c s e t o o f t t u r e m o e d l i n d e n c e o f m a l i g n a n c y

I i t t h i t m (F e b u a r y 1 9 0 9) t h u l t s a w t h e p a t i n t T h e s c a r s m b l e d t h a t i l l u t r a t d i n F i g u r 4 C s T h e p a t i e n t d e c r i p t n o f h s d i s c o m f o t n t h e l o e r l i p a n d t h o d a t t h e k s i n h i t l e l i p w l d s e l l d i n c l t h t h o e i n C s s a n d 3 I h a d t h e o p j u n t i v e t o e r u n n e t h e s e t i o n F i g u r 1 1 s h o s t h e h y p e t r o p h y o f t h e m u c o u s m e m b r a n e o v e r t h e s c a r a n d t h c i l l u l a s a t u e b e n a t h F i g u r 1 2 s h o a n a r e a o f t h e s c a c v e r d i t h t h a e p d e r m i b e n a t h h c h

t h e s a a s t v a p p e n t l i n d b e d o t h e l u m s u g e t i n g l y m p c y s t a n d t h e s u r r o u n d e d b y v c e l l u l a r v a s e l a r g n l a t i o n t i u i n h i c h i n p l a c e s e o g e m a o f g l a n d t i s e F i g u r 3 s h o s t h c h a n g e n t h l o b u l e o f t h m u c u g l a n d s u n d e d a n d i n v a d e d b y t h g r a u l a t i o n t i

The intermittent swelling of the lip in these cases may be explained by retention of secretion in the mucous gland or by the formation of lymph cysts. In all of the sections which I have examined I found both lymph cysts and remain of mucous gland tissue in the granulation scar tissue

In this case (Case 6) in view of my recorded previous experience I felt justified in advising against further operation. We had an examination of the tissue first removed by a well trained pathologist which practically exclude malignant disease and also an opportunity to re-investigate the sections of the tissue removed at the second operation. There therefore was no indication for re-operation on the diagnosis of possible malignancy and this experience again demonstrates that operation is not helpful in a carcinoma tumor occurring on the mucous membrane of the lower lip

## CONCLUSIONS

I have reported these six cases of scar tissue tumors occurring on the mucous membrane of the lower lip because my records show that the majority of surgeons are apparently not familiar with the rather frequent occurrence of a painful induration in the scar after the excision of a lesion on the mucous membrane of the lower lip and even in some cases experienced pathologists have diagnosed sections as suspicious of malignancy or even in one case (Case 3) of carcinoma.

However it was the experience with the last case (Case 6) which urged an immediate report. This patient had seen at least a dozen surgeons and dermatologists in four large cities and not one of them expressed the opinion that it was a simple scar tissue tumor none of them seemed to be familiar with the possible benign and malignant lesions of the mucous membrane of the lower lip.

Studying the records of the pathological examination Dr. Homer Wright of Boston seems to be the only one who has made a clear microscopic description and a positive conclusion that there was no evidence of malignant disease. The surgeon who operated on the patient in Case 6 for the scar tissue tumor advised I am informed a third and more extensive operation based on the view that it might be malignant in spite of the fact that the pathological examination of the tissues excised both at the first operation and at the second showed no evidence of malignancy.

These scar tissue tumors on the mucous membrane of the lower lip have apparently no relation to the nature of the primary lesion whether it be in the mucous membrane or in the submucous tissue. Apparently they are more apt to occur in the first instance when the primary lesion had been treated with caustics or when the wound has healed by granulation.

When I compare these six cases of scar tissue tumors of the mucous membrane of the lower lip with the resultant scar in small groups of cases in which I have had the oppor-



Fig. 13. Case 6. Pathol. No. 23866. An area in the scar tissue tumor showing mucous glands surrounded and infiltrated by granulation tissue.

tunity to excise the primary lesion of the mucous membrane of the lower lip. I find that in all of my own cases in spite of the fact that no cautery had been employed and that the area was excised with a sharp knife and that with few exceptions the wound healed by primary intention, slight indurations have always formed in the wound and some have been painful resembling therefore closely Case 4 but in none of these cases has a scar tissue tumor been of the extent or as painful as in Cases 1, 3 and 6 reported here.

These cases reported in detail with this discussion seem to present the problem clearly and to settle the method of treatment — non-interference.

It also emphasizes the fact which I have mentioned before of the importance of subjecting even the most innocent lesion to a microscopic examination and to keep the sections and some of the tissue for future study.

At a later date I shall discuss lesions of the mucous membrane of the upper and lower lip as well as scar tissue and granulation tissue tumors on other portions of the lips.

SOME POINTS IN WAR SURGERY<sup>1</sup>

By JAMES RUTHIFFORD MORISON M.D. F.R.C.S. NEWCASTLE UPON TYNE ENGLAND  
Surg. N. 10th mb. 1 d. W. H. tal

THE first point I should like to discuss is concerned with the reputation and mentality of the medical profession as the War has drawn special attention to it. All of you know how much doctors have done and how generously the value of our services has been talked about—but there is still a good deal wrong in our relations to the public and my view is that we should look facts in the face and ask ourselves the straight question—Why is it so?

Suppose one of us made a visit to the smoke room of the House of Commons or any other popular business club and heard a request by one of the members to be advised by those present as to the best man to consult because of a damaged knee. What do you think would be the verdict? Go to Sir Robert Jones? No, not at all. It would be almost unanimously. Consult Barker, the bone setter. On inquiring why we would be informed first that he is a genius with joints and second that he cures cases which the doctors have failed to relieve, not by one or by two, but by hundred. Do you believe it or do you not? If not, you are not looking facts in the face. Barker is a genius and he has cured hundred of cases which doctors have failed to relieve.

I therefore wonder that the refusal of his offer to treat wounded soldiers and the refusal of the military surgeons to appoint a commission to inquire as to his methods and result, which he offered to explain and demonstrate, should have caused bitter public feeling against the doctor? The man in the street calls it professional jealousy and the result has been such an advertisement for Barker as has made him so well known that he is now probably rich beyond the dream of avarice.

What do you think would have been the result from a surgical commission of inquiry? To a certainty it would have been that Mr Barker's reputation was based upon his

marvellous cures—upon the cases that came limping to see him with a crutch or stick and after a manipulative operation under an anæsthetic walked away from his consulting rooms sound men or women.

Sir Robert Jones knows these cases. He looks carefully for pathology and finds none. Says: There is nothing the matter with your joint. Give up that crutch and stick. Use the joint, it will soon be all right. This is not popular advice and the patient probably goes home with a sore undignified fraudulent sensation and does not advertise the experience. But Barker sees no pathology, only a disabled painful joint which he must cure by an operation under an anæsthetic and sends his patient home delighted and full of praise.

Here I should like to tell you how I think Dr. Crile, the celebrated American surgeon, would explain the marvellous cure of these lame and painful joints. He would say something like this: Pain to the individual is the most important thing in all the world because it acts as a stimulant to the chief of the primitive instincts—the protective. To our earliest ancestors a ruptured semilunar cartilage could be nothing short of a calamity. The pain and disability attending it would be accompanied by the fear of death from surrounding enemies as no escape by flight would be possible. The effect of strong stimuli on such an instinct is difficult to eradicate and in susceptible subjects is apt to leave a long standing mark which requires an extraordinary counter-irritant to remove it. A chase by a bull. Christian Science, the possibility of being drowned, operation by an imposing specialist, any of these may cure these lame and painful joints with no organic change in them now, but retaining still a memory of pain and disability and old injury.

Thus subject is of such enormous importance that I cannot leave it at that.



Figs. 2 and 3 Fracture of the right forearm. Private F. wounded July 3, 1917. Bipped in France. Admitted to the Northumberland War Hospital August 6, 1917. Examination showed bone in shortening and marked deformity of the right forearm. A large deep wound packed with bipped gauze. On removal of this the lower end of the ulna protruded from the wound. Operation August 31, 1917. At this time the forearm was reached into position and the ulna plated. On October 13, 1917, the wound was dressed for the first time. I expect for some time blood the dressing was limited. The wound had closed except a small area at the center. On October 8, 1917, the patient was removed. On January 6, 1918, probe penetrated into the wound. In March 30, 1918, the patient was discharged. The wound healed and the shape and all movements except supination were good.

We have recently had a visit here from Colonel Hurst and he lectured popularly and professionally on psychotherapy as applied to war injuries and diseases. Briefly his conclusions amounted to this. That all cases of shell shock of more than a few weeks duration the majority of cases of paralysis cases of deafness loss of voice frequent symptomless vomiting contracted painful stiffened limbs and joints without gross



Figs. 4, 5 and 6 Fracture of the tibia. Private H. was wounded November 4, 1918 by a shell. He was admitted to the Northumberland War Hospital November 15, 1918. If had a large elliptical wound measuring 3 1/2 x 1 1/2 inches with the bare fractured tibia exposed. There was a other similar wound on the posterior surface from which pus poured when dressing was removed. Operation November 19, 1918. The wound was explored and the fragments of bone and the foreign body seen in the plate were removed. The wound was bipped and a Lane plate applied. The patient is still in the hospital. The bone is firmly united and in good position. There is still a superficial granulating wound.

lesions sufficient to account satisfactorily for them were hysterical. Not only that but many conditions producing signs of organic disease were complicated by hysteria and if the hysterical part could be exorcised the patient utterly helpless before might once more become efficient for the ordinary duties of life. He exhibited photographs of cases treated by his colleagues and himself before and after the cure hopeless looking arms and legs cured in half an hour after unavailing treatment in other hospitals for months paralytics of months duration





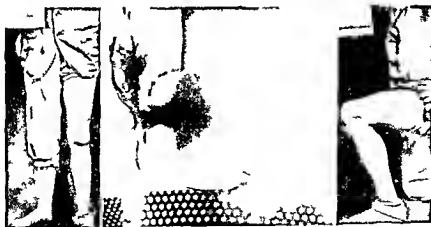
Fig. 1. d 8 ( h t d f t h r h t l g t h  
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N m b r 6 9 8 h t h g h t l g h m t m l  
d t h t h l f m l n d f m l m b d d l t  
b p p e d d p l t d L t t h e p l t h d h h t m  
h t t l d d g l l

pronounced elsewhere incurable walk in a few days. To cut a long story short he and his colleagues made the lame to walk the blind to see the deaf to hear and almost rused the sick and the dead and no one who heard the lecture and saw the pictures could if the facts were faced doubt the truth or importance of them.

What are the physicians going to do about this? The possibility of cure of such formidable conditions without an operation massage electricity ionization whirlpool bath radiant heat or heliotherapy ought to determine some activity. I hope that it may expend itself here on the establishment of a special neurological department of the infirmary.

Colonel Hurst described his method in some detail and called it psychotherapy. That of course is the guinea name. In ordinary language the patient is told "You are no longer ill" and is induced to take up his bed and walk. As in Mr Barker's cure the miraculous rapidity of Colonel Hurst's results is the striking feature and I want to emphasize this point.

When salvarsan was introduced for the treatment of syphilis two of my colleagues



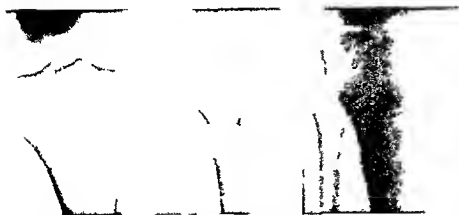


Fig. 13 and 14 Roentgenograms showing replacement of fat by bone. Corporal G. wounded April 6, 1917, by shell suffered a septic wound with skin gap of 1 inch leading into the head of the tibia. Operation June 10, 1917. Deep bone cavity involving almost full depth of bone was bipped and filled by fat graft from thigh. The cavity was covered over by thick skin flaps transplanted from inner side. August 10, 1917, healed.

went to London to judge of results for themselves and came back with an enthusiastic report. They told me that a single dose killed all the spirochæta and that in a few days the patient was cured. My reply was that I did not believe it; that syphilis was a real disease and that Nature's methods were always slow.

The public who are still always on the outlook for a miracle should be taught that a real disease cannot be so suddenly cured; an unreal one may. It scarcely helps to call the one organic, the other functional, hysterical or neurotic. The essential thing to understand is that patients may be divided into three classes: (1) those with real diseases, (2) those with real diseases and some unreal features superadded, and (3) those with unreal disorders. From Colonel Hurst's experiences it should be clear to everyone that the third class is of the greatest importance. Allowing for an excess of enthusiasm and a lack of the after-history of many of his cases, any just judge must admit that his cures are something extraordinary, more extraordinary than the advances made in the treatment of syphilis. The only comment I have heard about the lectures was made at the popular one. A gentleman I understand got up in the audience and said: "This is a put-up job to rob our disabled soldiers of their pensions. So it seems possible that the doctors may escape painful criticism."

It should be recognized that the dangers of this form of treatment are not small, because the result depends upon diagnosis, and this in the best hands is still too often uncertain. It is such a tragedy to treat a cerebral tumor or an organic paraplegia or a pathological joint as unreal, that everyone of us would rather err on the safe side and go on making mistakes, and this is the present difficulty. If no suggestion could be offered to diminish this risk, I would not have mentioned it, but this is my solution—military service has gone a long way to introduce it, and if the war lessons have been properly learned it should be easy to carry it through.

All cases then in which there is reasonable doubt as to diagnosis should be advised of

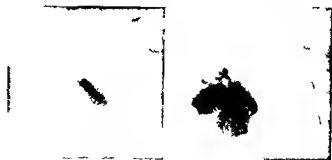


Fig. 15 and 16 Cavity in the calcaneus. Driver Y. wounded Oct. 1, 1918, admitted to Northumberland War Hospital October 4, 1918. January 8, 1919, cavity 1.5 inches deep, bipped and filled with three fat grafts. The ulcer healed. On January 5, 1920, the wound was dressed for the first time and a full healed except heron septic sinus had been eliminated.



I d d o C ty l l fth tba C P u d d A t  
o 7 d m t t d to \ th m l l d W ll p t l A t 6 o 7 w th s nt  
th h d t th tba Op t O t b 3 o 7 Th ity l ed  
b p p e d a d l l d th f t d d th k f l p

the difficulty and sent to hospital for team supervision and diagnosis. A physician surgeon pathologist specialists X ray operator bacteriologist and biochemists should be asked by the patient's doctor to help in solving the problem and if necessary a period of observation allowed before such drastic treatments as operation or psychotherapy are recom-

mended. This evolution ought to start with our profession who realize the need of it and the public would soon be impressed with its value and importance to themselves. Selfishness and professional jealousies have prevented its previous adoption. We have



Fig



Fig a d C m m t d f a c t e f t h t b  
t b l l d P t e M o d d A p l o 9 b  
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l m t t h V t h m b l d W a r H o s p t l J o  
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l g t h p p t g Th X 3 h d q e t r a  
t m e t h t t b O p e t J l y 3 o 8 a t h i c h  
f i l l i t h f t f m t l t h Th w o d a s  
d w t h k f l p Th p t t t d m t h  
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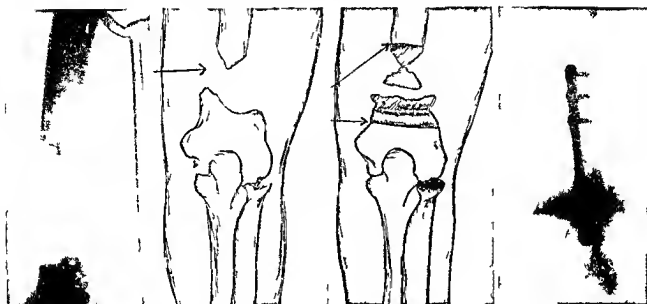


Fig 23

Fig 24

Fig 25

Fig 26

Figs 23 to 28 Septic compound fracture of upper arm. Gunner S was admitted to the Northumberland War Hospital September 1 1918. The roentgenogram shows the gap in the bone October 5 1918. Fig 24 a diagrammatic drawing of the roentgenogram the arrow pointing to the defect in the bone. Fig 25 shows the preparation of the humerus for bone graft. A transverse saw cut was made nearly through the bone and the bone ends still attached by soft parts then turned down into the gap. The arrows point to saw grooves.

Figs 26 27 and 28 Roentgenograms and diagrammatic drawing showing transplantation of graft from tibia into defect in humerus. Note that one screw at each end is holding the graft and two the shaft. The plate is too short. It should have been double the length above the graft. Fig 28 Diagrammatic drawing of roentgenogram. The result was abundant callus with firm straight union. The metal plate has not been removed.

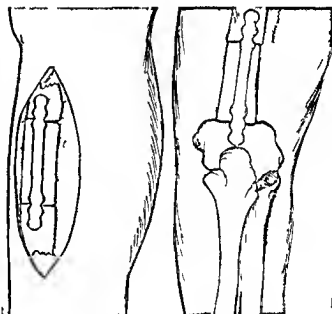


Fig 27

Fig 28

no business to worry anyone about the future of the medical profession until these have been scotched or if that is impossible repressed

#### WOUND TREATMENT

Surgeons have always been and are still too modest. In my early surgical days the physicians later the pathologists and at present the bacteriologists have dominated all our views.

Team work is now essential to progress but I hold that clinical experience and observation should still occupy the first place in surgical work and that it will be bad for surgery when they do not do so.

It is 41 years since my first paper on wound treatment was published in the transactions

of the South Durham and Cleveland Medical Society and at that time my views were regarded as revolutionary and no one faced the reported facts. Lister had proved by his magnificent work that operation wounds might confidently be expected to heal without suppuration or constitutional disturbance. The rule then was free tube drainage and frequent dressings—the same principles were taught in the early stages of the war for its infected wounds. My contention was that



Fig 2 (left)

1) (right)



Fig 3

Fig 3



Fig 33



Fig 4

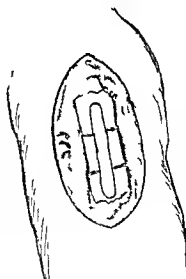


Fig 3

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 Th n d h l d d l d g h h

m l l t y 9 8 V y 4 9 4 m ths  
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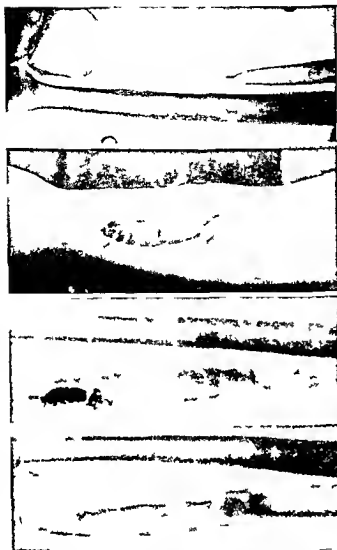


Fig 36 to 43 Extensive lacerating wound of the left forearm. Private B. United May 3 1917 admitted to Northumberland War Hospital May 10 1917, with extensive sloughing and of left forearm. The tendon and muscle exposed. The radius was shattered above the middle portion of the bone. Fig.

Fig 36 Roentgenogram taken February 1 1918.

Fig 37 March 6 1918 Flap separated healed. Note the cross scarring of flap.

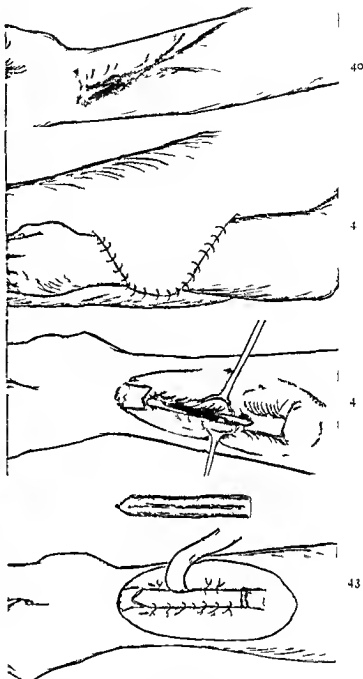
Fig 38 August 9 1918 Dressing and splint. It undisturbed for six weeks. The wound a laceration fully healed all sutures absorbed. Good union of graft.

Fig 39 October 6 1918 Four months after graft. The arm stronger than in the original position and function fair rapidly improving.

Fig 40 First of October 1918. Whole of radiating removed from forearm.

Fig 41 Flap turned off the hand and sutured over bare area of forearm.

Fig 42 Second picture. June 12 1918 Hand



were closed into good position. Broken end of bone exposed. Denuded cartilage throughout.

Fig 43 Bone ends prepared for reception of graft. Upper end laid on shelf of upper fragment and tied with catgut. Lower edge shaped end of graft fitted into lower fragment. The osteum of graft sutured with catgut to surround the scar tissue. Skin wound closed though not with catgut. At the end of the wound there was tension so covered with bipp.

if Lister's teaching was true open wounds made by the surgeon should heal as subcutaneous ones did without drainage without constitutional disturbance without the need

of removal of sutures if catgut was employed and under a single dressing. The cases reported in that paper and later many others because I renewed my attack from time to

44



4



46



Fig 5 Empty m I t t gu h t d  
 f tl h t Hem pn m th Th p t t  
 d d N emb o s d adm tt d to th  
 N th mb l d W Hosp t l D mbe 4 o s th  
 t mpe at f O D mbe o s t be  
 t d t th d d d h lf p t f th k  
 p t d J ry s o o pe t by P f  
 M Ch t as f ly pe d by de t of b  
 Tl f g b d a m d th a ty bpped t  
 l pped g p t d th ou d t d  
 th bpped lk pt h g p trud  
 Th h l d m d J s T bru v s 19 s  
 pe t p th d gs bo th

4



43



49



time as opportunity offered were the strongest possible evidence in proof of what I said but no notice so far as I know was taken of them. Surgical information moves along more rapidly now but still not quite so quickly as it should. It was at least twelve years later before I saw the after treatment of wounds develop at all in the direction I had indicated and even now non absorbable sutures and drainage are the rule.

No such ideal method of treatment for infected war wounds has yet been discovered but unlikely as it would seem experience suggests that the problem may eventually be solved. I have told so often since 1916 how it is possible to close infected wounds and even acute abscesses by suture always with impunity and frequently to obtain healing by primary union that it would be waste of time to go over the details again (They can be found in a small book on the *Bipp Treatment of War Wounds* published by the Oxford Press). The only addition I have made to the steps of the method described there is a valuable one. After closing the wound with sutures smearing it with spirit I sprinkle sterile finely powdered boracic acid freely all around the bipped wound and on the first layers of the dressing. This has diminished infection from the skin and lessened the dirty discharge which was found in granulating wounds that had been left undressed for two or three weeks. From the first I have specially drawn atten-

tion to the importance of this treatment in fracture cases (See Figs 1 to 8). At the present time there are 26 gunshot fractures of the long bones under my care in the Northumberland War Hospital. The average number of days those were left after operation without change of dressing was 13 and it would have been more if some of them had not been taken down for purposes of demonstration. More will be said as to the cases in which bipp has been found useful—it is of course as applicable in civil as in military surgery—when the pictures are demonstrated (Figs 9-10 and 50) but before dismissing this subject for the present I would like to read an extract from an article by Colonel Gask which was published in the January number of *SURGERY GYNECOLOGY AND OBSTETRICS*. He says

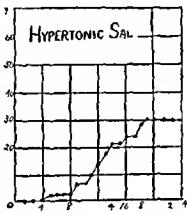
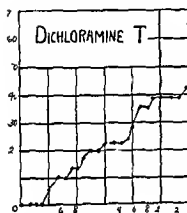
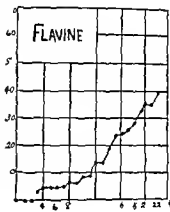
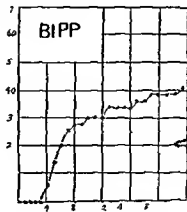
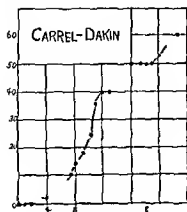
The most dangerous organism to the patient and the one that defeats our efforts up to the present is the hemolytic streptococcus. Primary suture failed in practically every case infected with this organism.

In July 1918 by invitation of the Director General A.M.S. I visited the Base Hospitals at Boulogne to demonstrate the bipp method of wound treatment. Three of the wounds on which I operated were in No. 14 General Hospital and I am indebted to the staff for reports of the cases and their after progress. The following are brief but exact extracts from the medical case sheets.

CASE 1. Pte P on admission to No. 14 General July 1, 1918. (1) Amputation stump left thigh just above knee long anterior flap sewn back. Fairly clean. (2) Open buttock wound—septic July 14, 1918 temperature 104 pulse 108. Stump bloody serous discharge wound of buttock very puffy swelling down thigh on outer side no localized collection seemed to be a general tissue invasion. July 15, 1918 streptococcus hemolyticus isolated from both wounds in fine culture. July 16, 1918 both wounds bipped and sutured by Professor Rutherford Morison. July 17, 1918 temperature 103.2 pulse 112 but felt more comfortable. July 20, 1918 temperature 99.4 pulse 92 much better no further puffiness. From this point on temperature never rose above 99. Pulse varied from 10 to 76 gradually quieting. August 9, 1918 (that is three weeks after operation when dressed for the first time according to my instruction (R.M.) the sutures were removed. The buttock wound was soundly healed. The amputation wound

S m m y f l k g U d x t h t l l y p e t h  
th w d w t h g g w t h m l t d d l  
th k d t h d g w t h m l t d d l  
Ope th wou d f ly d f p o b f f t t y t p e m t l  
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f r v u n t h m d f b l o o d s l s p e g t h l s t d  
f m l t h m l d l t l h m m p d w t h t f t h  
d b l y f f l w g r v d a m a g C l t m t y w t h d r y f l  
g m p t f k m p o o t d m h f r e b o d e s  
g v i p t h r r d g k d t h d e a y w t h m t h y t d  
p t d d r y t p t b i p p t h d l p t l t h p t  
f d f m r y f l y p o w d t 6 b u m t h b r a t s  
l q d p r a f g l l d m t h t q t y t h  
p d m d t g e t h l m r r d t h l q d p f  
p r o t d t h q t y f l c d p r a f d d g t t h  
b l k f t h p o w d r s t h b m t h p r t c u l b e g l b l t  
d b l m a t b l k A f m t q t y h l h d d d t  
m k h k p t l t t h d s a b l p o b w t h p e r d m l l  
q t t m t l b w p t t f r e e d m f m  
g d t h p t l f p o d R b t t p e r c i a l i z d  
(Th m b i p p g e t t h y t h g e d t b t h l t  
q t t b m t d o d f m m) R b t t g t h d r y g  
th t m l l l g l y t h g t h w o d





T 51 Ach str m V d li ch  
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 r l Daki bipp fla n d chloram  
 T nd hyp t lt p i g t t  
 bipp th most t germ d  
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 a h ut re t d d d n t d  
 t numb f d t k e t ch  
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was not h l l flap sh hly r t i j but quite  
lean nd granulating. D s h r g d i m hosp t i l n  
g o d e n d t o n. Heard fr m Au st o o 8 (one  
e k l t e) O K beng cr u d t o r t m p  
lumb

CASE 2. L cut Col B W th mput tio belov  
knee long e t r n l flap se n up th ut drama c n  
July 5 o n July 10 s at No 3 Gen ral sh n  
of st imp disc l b ed sut res remo ed. A collection  
of blood and pus as va ued Temp ture o  
Fule 00 July 5 1, 5 bacteriol scale am n t  
sho ed i n e ultu e h an ly t e strept coc us July  
16 j r d tump bipped nd sutur d by i roles or  
Rutherford M son July 10 s f a l y comfort  
able Temper ture 100 Fule 0 July 8 1, 8  
much better Temper ture 98 s Fule 9 s After  
th s th ngs an smoothly a fir s temperatu e id  
pul e nt but he h a l a go d d e l o t uneas ness  
stump an i ref red pa n n in the toot Au ust 9 1918  
(three weeks afte ope atio ) utures cmo ed The  
flap h d heal d but the e s a sinus o e r the m d dle  
of the flap he e the kin had broken do n At th  
t me of the ope tion th ki as rub r a r d  
a p e r f o t i t t h s p n t (s all gun lot nd  
bution hole s ture t i j mar operat n)

with success it looks as if Colonel Gask may  
have to alter his conclusions

The danger of bipp poisoning has been  
mentioned very frequently and in all my  
papers I have alluded to the possibility of  
it There is overwhelming evidence that it  
can occur but I need say nothing more about  
it now The mortality figures of operation  
performed in the Northumberland War Hos  
pital supplied by Major D Oyle Gran e  
prove beyond any question that it cannot be  
a serious danger because all of my colleagues  
there use the bipp method

The total number of operations performed to  
date was 5500 Of these 7 died a mortality  
of not quite 0.5 percent Only 10 amputations  
were performed No d ath was attribut ble  
to bipp —indeed I entertain no doubt that  
many lives and limbs have been saved by  
its use (Fig 51)

#### SECONDARY HEMORRHAGES

Secondary hemorrhages have added to the

If such large dirty looking wound as these  
were in patient obviously ill can be closed

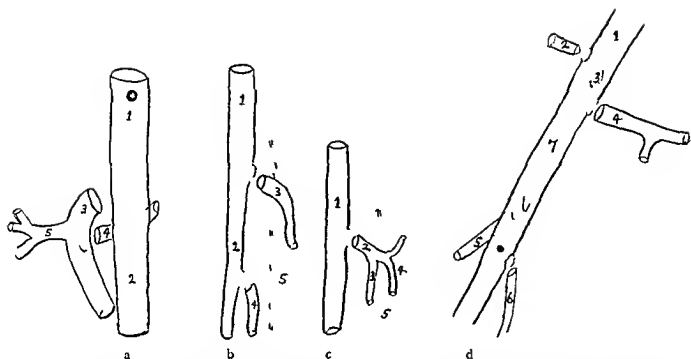


FIG. 5. Drawings illustrating special regions in the extremities likely to cause trouble in operation for traumatic aneurism due to bullet injuries and the places in them.

a 1 Common femoral artery (right) 2 superficial femoral artery 3 deep femoral artery 4 internal circumflex artery 5 external circumflex artery

b 1 Placental artery from the outer side 2 posterior tibial artery 3 anterior tibial artery 4 peroneal artery 5 interosseous membrane

c 1 Ulnar artery 2 common interosseous artery 3 anterior interosseous artery 4 posterior interosseous artery 5 interosseous membrane

d 1 Axillary artery 2 anterior circumflex artery 3 posterior circumflex artery 4 subscapular artery 5 superior profunda artery 6 inferior profunda artery 7 brachial artery

Illustration of the arterial system in the upper limb.

terrors of war wounds and there are many points in connection with these cases still open to discussion and settlement. Some figures given to me by Major D. O. Grange for cases on which he operated support a view expressed by me with particular reference to traumatic aneurism, and illustrated by him in the *British Journal of Surgery*.

The escape of an artery from a bullet is due to its elasticity and mobility. At points where branches arise the artery is tethered by them so that it becomes fixed and is pierced by the impact of the bullet and the branches are either torn through or caught and divided (Fig. 5).

Major Grange's cases include 50 from arteries from the popliteal vein. Of these 30 vessels were tied at the site of injury. Of the thirty in which the bleeding point was seen and tied 2 were close to branches of the artery.

There is one rule which should never be neglected and that is to open up the wound

freely and expose the bleeding area in every case. Picking through the wound will often suffice to stop temporarily a small hemorrhage but it so often recurs later that this should only be regarded as preliminary to a complete operation. Free opening and inspection with a good light may readily discover bleeding from a large vessel and then Guthrie's instructions can be followed and the vessel tied above and below the opening. If no large vessel is bleeding the wound should be bipped and left open with gauze pack. It is not so easy to decide what is to be done if bleeding recurs but I believe the main artery should be tied above the wound as close to it as it is possible to find an unaffected spot and the wound should be bipped and packed again—thus packing being left in for more than weeks.

In twelve of Major Grange's 50 cases the vessel was tied above the seat of injury and the wound was packed. 8 wounds were simply packed. In the whole series there were 7

deaths 2 before operation one during operation one from sepsis four days after operation one from septicæmia after hæmorrhage from the popliteal vein No case died from recurring hæmorrhage after operation for hæmorrhage

Every surgeon who has done vascular surgery must recognize the uncertainty of it. A very trifling interference will cure one aneurism another of the same vessel and having similar characteristics but in a different individual possesses all the malignancy of a cancerous growth. In two persons apparently similar cases the results may be widely different. After ligation of the main trunk in one there may be no circulatory disturbance while in the other there may be gangrene of the limb below. In hæmorrhage the same uncertainty applies. Theoretically ligation of the main trunk above an indiscoverable bleeding point should cause gangrene if it arrests the bleeding but practically the bleeding usually stops and gangrene of the limb does not often occur. In the exceptional case bleeding is not arrested and gangrene follows ligation of the vessel above.

#### BONE INFECTIONS

One of the surprises of the war has been the rarity of pyæmia after bone infections.

Acute pyæmia followed by death no infrequent result of bone infections in civil life has been almost unknown in war surgery. Subacute forms of it with comparatively mild joint infections have been less rare but even these have been uncommon. The chronic variety of pyæmia leading to ankylosis of many joints and recovery with serious crippling I have not seen at all.

More or less bone infection has followed most of the fractures that have been sent to this country and they have arrived already infected. The consequence has been much bone necrosis and a large amount of our surgery has been for the removal of sequestra. The subject is too large for discussion now but it is so important that I hope it will be fully dealt with elsewhere in the near future. Bone sepsis as I know it is a much more serious thing than is generally realized and in many of the cases I have seen it has been

the cause of a painful and lifelong disability. An infected bone either following a septic compound fracture or of the blood infection variety may apparently recover but from time to time fresh trouble recurs in it and painful attacks of inflammation lead to sclerosis or more or less destruction of the bone. One patient I saw had had such an attack in one or other of his long bones almost every year from the age of 13 to 73 when I last saw him. I have seen many other instances of this. It would seem that the staphylococcus having once acclimatized itself to the skeleton and long bones has a special tendency to locate itself in these. It is too early yet to say what percentage of our healed case will have further general or local trouble after infection of their bones but several which appeared to be soundly healed have returned after weeks or months with renewed local mischief.

#### BONE CAVITIES

There are numbers of men going about incapacitated by discharging bone cavities and every surgeon has found them difficult problems to tackle when the holes were of good size and in positions where it was impossible to chip away the edges and flatten them out. Those in the lower end of the femur the upper end of the tibia the os calcis the ilium and the upper end of the humerus occasion most trouble (Figs 12 to 19).

We have now found that we rarely fail to secure healing by the use of bipp and fat grafts and I am going to show X ray pictures of some cases before and after operation (Figs 20 to 22). Unfortunately in some cases though very few so far as I know healing has occurred but weeks or months later an abscess has formed and discharged leaving a sinus communicating with the cavity and the work has had to be done over again. As a rule these cavities promptly heal and the fat packing is replaced by bone.

#### BONE GRAFTS

There is no more satisfactory surgery to be done than bone grafting and though there is much in detail yet to be learned about

it the principles governing the use of bone grafts are now so well understood that it is safe to say that failure to secure satisfactory results is due to faulty technique.

All surgeons who know anything about it agree that asepsis is of the greatest importance and that the graft should be firmly fixed and held in contact with a raw surface of living bone until union has occurred.

Albee teaches that grafts must *in situ* be placed in scar tissue and that they must not be fixed by any unabsorbable material. One of my illustrations shows a new radius which has grown from a graft lying in a bed of dense scar tissue so little vascular that I had small hope of a good result (Figs 36 to 43). In several cases I have used Lane's plates with success (Figs 3 to 35) and until I find that I am mistaken will continue to believe that there is no other means so well calculated to secure efficient immobilization provided the bones are hard enough to

hold screws. If scarred skin flaps are used to cover grafts they are apt to break down and expose the bone. This result may generally be prevented by crisscross superficial incisions which avert oedema and tension of the scar tissue.

Before operating in the presence of scars our rule is that they should either be excised and replaced by transplanted flaps or should undergo a course of radiant heat for 10 to 14 days in preparation. We learned this from A. E. Morison. Our records show that 10 per cent of the earlier cases in the Northumberland War Hospital developed abscesses or broke down when their scars were exposed to radiant heat. If they remain healthy after 10 days of this treatment we are confident that infection from the old wound will not follow operation.

The illustrations show methods I have employed to secure contact between the graft and the bone.

## PRIMARY SUTURE OF GUNSHOT WOUNDS

WITH SOME REMARKS UPON THE APPLICATION OF SIMILAR PRINCIPLES IN CIVIL SURGERY<sup>1</sup>

BY SUMNER L. KOCH, M.D. Chicago

Of the urgent advances which the experiences of the war have brought to us one of the most important from the standpoint of the civil surgeon seems to us the knowledge that under appropriate conditions recent infected wounds may be excised surgically cleansed and sutured with the confident expectation of primary healing in 85 to 90 per cent of cases. The following series of cases is reported as an illustration of the results obtained in late primary excision and suture of gunshot wounds with the conviction that the same methods may be applied with equal or greater success by the civil surgeon in the accidents and emergencies of civil and industrial surgery.

At the very outset of the war primary excision followed by immediate suture was recognized as a valuable method of treatment of gunshot wound and was successfully applied by various French and Belgian surgeons. When attempted on a wider scale and under more or less unfavorable conditions a number of disastrous results followed with the result that the method was temporarily abandoned in favor of various antiseptic method of treatment. Gradually, as Sir Anthony Bowlby (1) has shown as the essential conditions for success were realized and as a more perfect organization permitted their fulfillment the method was more and more widely used in cases of increasing severity and with constantly improved result.

Many different surgeons took a prominent part in this development. Crook (2) and his associates (3), Lemaitre (4), Duval (5), Marquis and his associates (6), LeGrand (7), Potherat (8), Huguet and his associates (9) of the French medical service. Gray (10), Drummond and McVee (11), Hyscraft (12), Morrison, Hurlley and Bashford (13), Fraser, Stokes and Titler (14) of the British and Canadian medical services. Cunningham (15), Crile (16), Brock (17) of the American medical

service as well as many others the results of whose work are not available at the present moment.

During the summer and autumn of 1918 a concerted effort was made throughout the British base hospitals to apply at the base the methods which these leaders so successfully applied at the front. Colonel Owen Richards, consulting surgeon to the British base hospital at Camiers, Lieutenant Colonel Hubert Cabot of 22 General Hospital, Colonel F. A. Besley, Major P. L. Nusbaum and Major M. R. Chise of 18 General Hospital (American Base Hospital 1) and Colonel C. W. Crile of 9 General Hospital (American Base Hospital 4) among many others lent their influence and took an active part in accomplishing results which seemed to us to mark a distinct step forward in the surgical work of the base hospital.

The splendid results reported by Lemaitre, Gros, Duval, Fraser and others take on greater significance when it is remembered that they operated upon a much higher proportion of severely wounded cases than did the surgeons at the base. During period of stress it was the patient with the slighter wound, those who were considered as being able to travel safely without operation that were sent to the base. On the other hand in the advanced area the surgeons were able to operate upon their cases within a relatively short time after the receipt of injury. Duval's (5) cases were operated upon at an average interval of 7 to 8 hours after being wounded. He considered an interval exceeding 12 hours between the time of injury and operation as a contraindication to primary excision and suture. Crook (2) cases were operated upon after an average interval of 8 to 10 hours. He considered 12 to 18 hours as the maximum interval. Fraser's (14) cases were operated upon at an average of 11 hours after being wounded.

In the present series cases were operated upon 36 48 and even 7 hours after being wounded with results which before the summer of 1918 we would have considered impossible of attainment. One hundred forty-one cases with 161 wounds 81 of them with retained foreign bodies were treated by primary excision and suture at an average of 49 81 hours after the receipt of injury. Of the 161 wounds 116 were flesh wounds 45 were complicated by bone joint nerve or tendon injury. Of 116 flesh wounds 99 (85 3 per cent) were completely successful (Figs 1 to 4) 11 (9 5 per cent) were partially successful 6 (5 2 per cent) were complete failures. Of 45 complicated wounds 26 (57 7 per cent) were completely successful 17 (37 7 per cent) were partially successful 2 (4 6 per cent) were failures. Of the total 77 6 per cent were completely successful 17 4 per cent were partially successful 5 per cent were failures.

The series of cases reported here represents only a small proportion of the cases similarly treated at 18 General Hospital (American Base Hospital 1) with equally good or better results. Major P. L. Nusbaum, Major M. R. Chase, Captain G. N. Krost, Captain J. J. Lebowitz, Captain J. F. Jaros, Captain E. O. Ravn, Captain C. J. Gaspel, Captain H. L. Baker, Captain C. W. Robertson, Captain E. R. Talbot, Captain R. W. Eaton and Captain W. L. Sieverth shared in this phase as well as in the other surgical work of the hospital in a way and with results that elicited fine commendation from the British authorities under whom they were serving.

In the treatment of uncomplicated flesh wounds the technique followed was that consistently recommended by surgeons of wider experience: careful cleansing of the skin about the wound, complete excision of the damaged tissues and careful coaptation of the skin edges in suturing with obliteration of dead spaces by deep sutures. Every effort was made to excise as narrow an edge of skin as possible at the margin of the wound in order to obviate tension on the superficial tissues in closing the wound. In gutter wounds and superficial wounds when possible the damaged tissue was excised *en masse*

without permitting the scalpel to enter the contaminated field. When this was possible no antiseptics were left in the wound. Where the damaged tissue had to be removed piecemeal the wound was swabbed before suturing with methylated spirit. In a few cases a small piece of rubber glove drain was left in one corner of the wound and removed 48 hours after operation. No dye solutions were used to stain the damaged tissue.

The treatment of complicated wounds obviously offered more difficulties than that of flesh wounds, but the principles as has so frequently been pointed out, were the same: complete excision with removal of all foreign bodies and devitalized tissue. In the treatment of head wounds the suggestions outlined by Cushing (15) were carried out: operation under local anesthesia, removal of the injured bone *en bloc* in penetrating wounds, aspiration of the disorganized brain tissue and blood clots with a soft rubber catheter, careful removal of bone fragments and foreign bodies and gentle irrigation of the cavity with salt solution. In the treatment of bone injuries all bone fragments were removed subperiosteally with sharp periosteotomes, the rugines of Ollier as recommended by Leriche and his associates, and every attempt made to remove all the tiny bone fragments invariably driven into the soft tissues about the site of fracture. In these cases following the primary operation the wound was usually packed with paraffin gauze or flanne gauze and at the end of 48 hours a delayed primary suture carried out under nitrous oxide anesthesia. This delay with the resulting decrease of swelling and edema sometimes permitted suture in cases in which it would have been impossible at the primary operation.

Following the suggestions of Captain Fraser and numerous other writers every attempt was made at complete immobilization of the wounded part following operation. Most wounds of the arm, forearm and hand were splinted; all wounds of the upper extremity were placed in a sling. Entry and exit wounds of the thigh or leg and all wounds about the knee were placed in a Thomas or right angled leg splint. The majority of

patients were kept in bed for several days at least those with wounds of the lower extremity until healing was complete.

Wounds were not dressed for 12 hours if the patients were comfortable and the temperature not alarming. Except in those cases which were complete failures the patients complained very little they slept ate well in few cases did they require any sedative aside from the one fourth grain of morphine given before operation. In those cases which were returned a part of the sutures were removed at the end of 10 days the remainder at the end of 14 days. It was not possible to return all cases for 14 days some were evacuated at the end of 7, 8 and 10 days. In those cases the sutures were left in place and immobilization maintained.

The successful cases need no comment. Sir Anthony Bowlby (1) has pointed out the tremendous advantages of successful primary excision and suture from the standpoint of the patient as to time as to freedom from pain and suffering as to ultimate function from the standpoint of the hospital and staff in the tremendous reduction in labor dressings and postoperative care and from the standpoint of military efficiency.

With reference to the partially successful uncomplicated cases we felt that in no case had the patient not gained by the attempt to excise and suture the wound. In no case was it necessary to completely open the wound and resort to active counter measures to combat the infection. In three cases one or two sutures were removed to permit the escape of localized pus. Following this the wounds cleared up rapidly. In four cases there was superficial infection not involving the depth of the wound. In one case which was dry until the stitches were removed there was a discharge of thin yellow serum for three or four days following the removal of the sutures. This disappeared completely at the end of that time. In three cases due to tension there was considerable separation of the skin edges which was accompanied by a slight purulent discharge following the removal of the sutures.

Of the six failures five were due to infection by hæmolytic streptococci.

In the first case there was a slightly infected wound near the midline of the neck. A small foreign body was located near the right common carotid artery. The entry wound was closed on the fifth day the track followed for some little distance and then lost. The patient was taken into the lavatory room and the foreign body as seen to be very small by the 5 inches from the wound of entry. The wound was sutured without further treatment. Twenty-four hours later the patient's temperature was 102.6 his neck was brawny and swollen and he complained of intense pain and difficulty in swallowing. The sutures were removed immediately liberating a small quantity of thin pus which showed numerous hæmolytic streptococci on culture. The symptoms subsided promptly thereafter and two weeks later the wound had healed.

In the second case there was a wound of the abdominal wall just below the umbilicus which had been excised and sutured 44 hours after the receipt of injury. A foreign body had apparently been removed nearer the front but the bottom of the wound which did not involve the peritoneal cavity was still filled with dirt and cloth. The wound extended into the right rectus muscle was completely excised and sutured. Thirty-four hours later the patient's temperature was 99.8 and he complained of much abdominal pain. The wound was examined and a thin dark brown turbid fluid found oozing from between the sutures. All the sutures were removed and two hourly irrigations with Dakin's fluid started at once. The patient's temperature promptly fell to normal and the subsequent course was uneventful. Culture of the discharge made by Captain W. S. Gibson showed large numbers of hæmolytic streptococci.

In the third case there was a deep badly infected gutter wound of the right deltoid region which was completely excised and sutured 37 hours after the receipt of injury. Seven hours later the patient's temperature was 102.8 his pulse 120 and he looked very ill. The tissues about the wound were brawny and reddened thin pus was beginning to ooze from between the sutures. The sutures were removed immediately and Carrel-Dakin treatment started. The temperature fell rapidly and Carrel-Dakin treatment was discontinued on the sixth day. In the three remaining cases there was a superficial wound in one of the neck in two of the forearm operated upon 48, 66 and 48 hours respectively after being wounded. Clinically they presented the same appearance as many other wounds which had been successfully sutured. In all three a seropurulent discharge appeared within 48 hours but in two cases showed hæmolytic streptococci on culture.

#### COMPLICATED CASES

The 45 cases complicated by bone joint or tendon injury included

11 cranial wounds—with extensive extradural hemorrhage, with dural penetration—



Fig 1 Case 10 Gutter wound of inner aspect of right elbow with large foreign body and cloth lodged at one end of the wound. Completely excised and sutured 46 hours after receipt of wound.

The patient also had small gutter wound of the right shoulder and chest wall and two wounds of the right hand with retained foreign bodies and with fracture of the ulnariform bone. One foreign body having passed almost completely through the ulnar side of the carpus. All the wounds were excised, the foreign bodies removed from the hand and the wound sutured. Thirteen days later Captain Lebowitz noted Sutures removed. Primary union in all wounds except for superficial suture abscess of one wound of the hand.

5 facial wounds with fractures of one or more bones of the face

- 1 with fracture of the hyoid
- 1 with fracture of the sternum and ribs
- 2 with fractures of the scapula
- with fractures of the humerus

4 with fractures of the radius including one with partial and one with complete division of the median nerve

with fractures of the ulna including one with complete division of the ulnar nerve

- 2 with fractures of the carpus

5 with fractures of the bones of the hand including two with division of the extensor tendons

- 1 with fracture of the sacrum
- 1 with fracture of the fibula
- 1 with fracture of the calcaneus
- 1 with penetration of the shoulder joint
- 1 with penetration of the wrist joint
- 3 with penetration of the knee joint

with division of extensor tendons of hand

1 Cranial wounds. Of the 11 cranial wounds 1 was associated with extensive extradural hemorrhage 7 with depressed fracture without dural penetration and 3 with extensive injury of the bone and dura



Fig 4 Case 4 Badly infected gutter wound of scalp without bone injury excised and sutured 41 hours after receipt of injury. Healing complete on the twelfth day.

The first case entered the hospital four days after being wounded with a shallow laceration of the scalp over the left parietal area and without evidence of cranial injury. On getting out of bed on the seventh day he developed a severe generalized convulsion lasting five minutes. Six hours later he had a similar convulsion followed by partial loss of consciousness and partial paralysis of the right facial nerve. Four hours later under local anesthesia the wound was excised and from underneath a linear fracture of the frontal and left parietal bones an extensive extradural clot was evacuated. The bleeding vessel a branch of the anterior division of the middle meningeal artery was ligated. The dura was incised and a considerable amount of blood tinged cerebrospinal fluid under tension permitted to escape. The dura and scalp were sutured. The day following operation the patient had two more severe generalized convulsions. Lumbar puncture showed a normal spinal fluid with no increase of tension. Recovery thereafter was slow and uneventful. The wound healed by primary union. The weakness of the right facial muscles was considerably less marked when he was evacuated three weeks after operation. There were no other objective symptoms.

The 4 cases without dural penetration were operated upon at an average interval of 61 hours after being wounded, the shortest interval elapsing between the receipt of wound and operation being 5 hours the longest 83 hours.

In 3 cases the frontal region was involved in 1 the mid line over the longitudinal sinus in 1 the left parietal region in 2 the occipital region





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t f t j r y t k d t h p t h k l l  
t d l l t b C t t l p l l l  
m l t t l d f o t h p t t t m p e t  
t h l t t o t v t m l l l t t

In the first case the dura pul t l follo ng the  
m val i the leg e se l l o In the l t t r  
th l u a a ten a n l p u l a t i a b s t In  
b th c o n l e b l e l a k l u i l b l o o l a d a m l l  
m u n t f n e c r t e l r i n t a c a c u a t e d o n  
n i n g the l u In a l l p t the l a s t a the  
u n l h e l e d b y p m a u n i n l n t h l a s t  
p a r t o f t h s u t r e m o e d o t h e t h l d a y  
a n l t h o u d d h a g e d s r o n g u i n o u s l u i f  
e h t l a s T h e r e c n o f u t h e r c o m p l a t i o n  
I n t l m n t h t h e a s a d t u n d o f t h e  
r i t h s i d e t h f o r e l d w i t h t h n e l s o f b o n e  
n d l r n s u l s t n B e c u s f t h e i p p a r t  
h o p e l n e o f t h a n t h t r s o f o k n o  
o p e r a t i o n a t t e m p t e d u n t l t h e v e n u g o f t h e  
d v f l l v i g h a l n i n o h u a l t t h e  
r e e p t o f t h e o u l A t t h t t i m t h e c l p o n d  
s l t h e l a m a l l b a n t u e s h e d  
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l l l l b r o u g h t o v t h e p e l b r a n t u  
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s m l l o p n i n g h h s t l l s h g l l p l  
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The latter two case represent the only  
fatal case in the series

*Wounds of the face* Of five different  
wound as ocated with fracture of one or

more of the bones of the face four healed by primary union

The first was accompanied by a fracture of the right malar bone and of the pterygoid plate of the sphenoid. A small foreign body had passed through the latter and lodged in the right infratemporal region. The bone fragments were removed, the foreign body not found. The wound was excised and sutured. The second was accompanied by a fracture of the malar bone, the third by a fracture of the right maxilla and ethmoid (Fig. 5), the fourth by a fracture of both maxillae. All four were excised and sutured 34, 36, 32 and 30 hours respectively after being wounded. From three foreign bodies were removed. All healed by primary union. In the fifth case there was a comminuted fracture of the mandible with a small opening into the oral cavity. The wound was excised, a deformed machine gun bullet and many loose bone fragments removed, the opening into the mouth closed by a suture and the external wound sutured. The operative wound healed rapidly, but five days after operation a swelling appeared in the midline of the neck just above the hyoid bone. This was incised and a small quantity of thick foul pus evacuated. The discharge cleared up rapidly and the further course was uneventful. The operative wound healed by primary union.

**3 4 Fracture of the hyoid. Fractures of the sternum and ribs.** 55 and 28 hours. These both healed by primary union.

In the latter case a shrapnel ball had ploughed across the anterior aspect of the chest wall fracturing the right fourth rib, the sternum and the right fifth rib without penetrating the pleural cavity. Following operation the patient's pulse became very rapid and irregular, he became cyanotic and for some hours remained in a state of profound shock. No treatment was given except morphine and the application of artificial heat. Six hours later he was resting comfortably and thereafter showed no signs of cardiac or respiratory embarrassment.

### 5 Fractures of the scapula

In the first case operated upon 34 hours after being wounded, sutures were put in place at the primary operation to be tied within 48 hours. They were overlooked and when the paraffin pack was removed and the sutures tied on the sixth day the edges of the wound had already become covered with epithelium, thus preventing complete healing by primary union. There was no microscopic infection. In the second case 38 hours old, a slight discharge appearing three days after operation necessitated the removal of two sutures, permitting the wound to gape in the center. There was no gross infection and recovery was uneventful following the removal of the sutures.

**6 Fractures of the humerus.** Both of these were only partially successful.

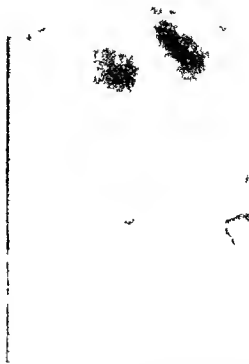


Fig. 5. Case 5. Gunshot wound of the face with compound fracture of the right maxilla and of the ethmoid involving both the nasal and oral cavities. Wound excised, foreign body and bone fragments removed and wound sutured 3 hours after injury. Primary union.

In the first operated upon 32 hours after being wounded there was an entry and exit wound with extensive comminution of the upper one third of the humerus. Both wounds were excised, the loose bone fragments removed and the wounds sutured. The following day the patient's temperature was 101.8 and the arm was considerably swollen. Twenty-four hours later two sutures were removed from the posterior wound and a small quantity of thin pus liberated. Following this the temperature receded and further progress was uneventful. The anterior wound healed by primary union. The posterior wound was clean and granulating when the patient was evacuated 18 days after operation.

In the second case involving the lower one third of the humerus the anterior entry wound was excised, the bone fragments removed and a deformed machine gun bullet removed through a posterior counter incision. The posterior wound was sutured, the anterior wound packed with paraffin gauze. A moderate amount of thin discharge followed the removal of the pack after 48 hours. This cleared up after eight days without special treatment when suture was completed.

**7 Fractures of the radius.** Two of these (Figs. 6 and 7) were completely successful.

The third case with partial laceration of the median nerve was operated upon 40 hours after being injured and sutured 48 hours later. A slight dis-



Fig. 1. Coe-Koontz method of fixation of the carpus.

### 9 Fractures of the carpus

In the first case operated upon 53 hours after injury a machine gun bullet had passed from the palmar surface through the ulnar bone and lodged in the soft tissues of the dorsum of the hand. Recovery following operation as usual and the patient's temperature remained normal throughout.

In the second case operated upon 46 hours after injury small stitches closed the wound about one of the ulna. The temperature remained normal throughout and recovery was successful.

10 Fractures of the bones of the hand including two of the distal ends of the extensor tendons. Four of these operated upon 3, 34, 56 and 66 hours respectively after being wounded were completely successful.

In the fifth case operated upon 30 hours after injury the right thumb had been shot away leaving a short stump which was amputated at the metacarpophalangeal joint. The amputation and bled came lightly infected necessitating the removal of the suture.

### 11 Fracture of the sacrum

In this case a hrapnel ball had penetrated the pelvis through the right buttock passing through the sacrum and lying just in front of it near the midline. It was removed with considerable difficulty 36 hours after injury.

The wound was closed and the bone fragments remained in place. The patient's temperature was shown by the accompanying chart (Fig. 8). The wound was closed 40 days after operation but the sutures were all left in place and the wound was completely healed on the tenth day.

### 12 Fractures of the fibula and calcaneus

The case was operated upon 33 and 4 hours respectively after being wounded. In both cases the fragments were removed and in both healed in place. Primary union.

The patient was operated upon 45 hours after receipt of injury. The wound exposed the bone fragments. The wound was closed with the patient in the prone position. The patient's temperature remained normal throughout the operation. The patient was discharged on the thirteenth day. The wound healed completely. The patient was discharged on the thirteenth day.

### 8 Fractures of the ulna

The patient was operated upon 45 hours after receipt of injury. The wound exposed the bone fragments. The wound was closed with the patient in the prone position. The patient's temperature remained normal throughout the operation. The patient was discharged on the thirteenth day. The wound healed completely. The patient was discharged on the thirteenth day.

In the second case operated upon 40 hours after being injured the ulna was fractured. The wound was closed with the patient in the prone position. The patient's temperature remained normal throughout the operation. The patient was discharged on the thirteenth day. The wound healed completely. The patient was discharged on the thirteenth day.

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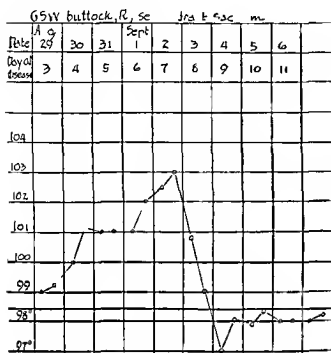


Fig 8 Case 7 Shrapnel ball penetrating pelvis through right buttock and fracturing sacrum. Wound excised, shrapnel ball removed and wound sutured 36 hours after injury. Temperature 101.5 on the third day after injury. Temperature rose to 103 on the fifth day thereafter. Uneventful recovery. Healing by primary union.

#### 14 Penetrating wound of the shoulder joint

This patient operated upon 8 hours after injury had three dirty wounds about the right shoulder. His temperature at the time of operation was 100. The first wound in the supraclavicular triangle was very deep, the track running downward and forward behind the junction of the outer and middle thirds of the clavicle. Two foreign bodies and some cloth were removed; the wound was excised and packed with paraffin gauze. Through the second wound on the outer aspect of the shoulder a small foreign body had penetrated the joint cavity leaving a dirty infected track. The wound track was carefully excised; the foreign body removed and the wound sutured without attempting to suture the capsule itself. The third wound was comparatively superficial. It was completely excised and sutured. Following the removal of the paraffin pack from the first wound 48 hours later there was a slight thin discharge which continued for several days. The other wounds healed by first intention. The patient's temperature is shown on the accompanying chart (Fig 9).

#### 15 Penetrating wound of the wrist joint

A small foreign body was removed from the left wrist joint through the excised entry wound on the dorsum of the wrist 48 hours after injury. The

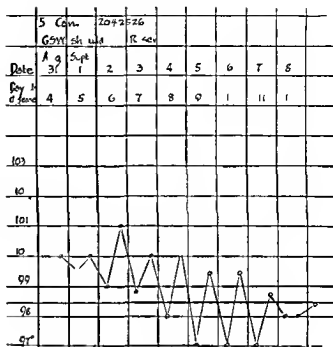


Fig 9 Case 9 Three dirty wound with retained foreign bodies about the right shoulder including one which had penetrated the joint cavity. Two wounds including the one involving the joint were excised; the foreign bodies removed and the wound sutured 78 hours after injury. The third wound which extended deeply behind the clavicle was excised; two foreign bodies removed and the wound loosely packed with paraffin gauze. The third wound healed by primary union. The third wound discharged thin serous fluid for a few days.

joint capsule and skin were sutured immediately. The patient's temperature was never above 99.8 following operation and healing took place by primary union.

#### 16 Penetrating wounds of the knee joint

The first patient was operated upon 78 hours after being wounded. One piece of shrapnel 1 by 0.5 centimeters had penetrated the right knee joint fracturing the patella longitudinally; a second piece lay below the patella buried in the quadriceps tendon. The knee joint was filled with bloody fluid; the synovial membrane was of a dark mottled red color intensely congested and edematous. Both wounds were excised; the foreign bodies removed; the periosteum of the patella was sutured; the joint cavity closed and the external wound sutured. There was some effusion into the joint cavity following operation and the patient's temperature remained at 101 to 101.4 for several days. The effusion gradually disappeared; the fever subsided and recovery was absolutely uneventful.

The second case was operated upon 56 hours after being wounded (Fig 10). A small shrapnel splinter had penetrated the joint cavity and stuck in the articular cartilage of the femur. The wound was



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the tube er removed and the wound permitted to heal by granulation. Recovery was slow but successful.

I have with many successful results obtained even in knee joint injuries. I feel that if the forearm had been amputated the primary repair of the wound could have healed without effect.

#### 17 Division of the extensor tendons of the hand

The case here operated upon 36 and 3 hours respectively after injury. In the first the extensor tendons of the ring finger were divided by a gliding motion of the forearm of the patient. In the second (Fig. 1) the extensor tendons of the index finger and the extensor carpi radialis were divided. The wound receded and the tendons and surrounding tissue in both cases healed as primary healing.

#### DELAYED PRIMARY SUTURE

Simultaneously with the above series of cases we were able to observe the equally successful result of a number of cases of delayed primary suture for which however we can claim little credit as the important part of the operation—the primary excision—was done elsewhere and the case evacuated to us for suture and postoperative care.

In this series there were 34 cases with 37 wounds excised on an average of 16.3 hours after the receipt of the wound and sutured.

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excellent drainage of the blood and the evacuated from the joint. The forearm body was moved with joint capsule and wound sutured. Recovery was successful. The patient had a penetrating wound of the left forearm, left hand for right thigh and left hand of both hands. Forearm body removed. In the three fingers and the wound successfully excised and sutured.

The third case was operated upon 48 hours after the receipt of injury. The wound of entry on the outer side of the left knee joint was closed. The track followed into the joint but the finger body shown on radiographic examination not found. The wound was sutured. The day after thick sanguinous fluid was found coming from between the sutures. The patient's temperature was 101. The wound was taken to the operating room the same evening and the finger body deeply buried in the cancellous bone. The motion of the original wound by the distal flap. The acute case was made on the inside of the joint and two Carrel tubes inserted on the side of the joint cavity. Two hours later the drainage fluid was carried out so for 48 hours.



FIG. 1. Case 56. Entry and exit wound of the left arm with comminuted fracture of the humerus. Wound excised, loose bone fragments removed, wound packed with flanne gauze at the front. 91 hour after the receipt of injury. Five days later the pack here removed and both wounds sutured at the base.

Th to ph 135 later lateral wound completely healed slight discharge from medial wound. (The apparent pressure on the arm from the splint is due to the temporary elevation of the arm to permit a view of the dorsomedial aspect.)

on an average of 62.6 hours after the primary excision. Of these 31 were completely successful, 5 were partially successful, 5 were failures. Of the wounds 7 were uncomplicated flesh wounds, 9 were complicated by bone or tendon injury, 1 involved the ankle joint. Of the complicated wounds 3 were associated with fracture of both bones of the forearm, 1 with fracture of the radius, 1 with fracture of the ulna, 1 with fracture of the humerus (Figs 12, 13), 3 with fracture of the metacarpals and division of the extensor tendons.

In 13 cases the wounds had been packed with gauze saturated with flanne solution. This number included the three partially successful cases and one failure. Five cases had been clipped and one packed with esol gauze. These all healed by primary union.

The three failures followed ill advised attempts at the beginning of our experience to suture flesh wounds in which there was macro-



FIG. 13. Case 56. Roentgenogram taken 12 days after injury.

scopic evidence of infection upon the removal of the original dressing and gauze pack. In one case the original excision had been carried out four days previously and suture was attempted by way of experiment. In all three cases cultures of the wounds made by Captain W. S. Gibson at the time of suture showed profuse growths and within 48 hours pus began to ooze from between the sutures necessitating their removal.

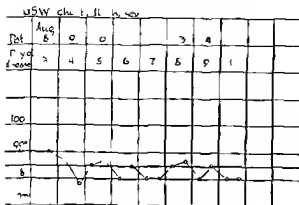
The partial successes occurred in cases where it was impossible to completely close the wound because of tension on the superficial tissues. These included two flesh wounds and a third with involvement of the ankle joint. In none of them was there macroscopic evidence of infection and the uncovered areas were clean and granulating when the patients were evacuated.

In three cases in which bacteriological examination showed organisms to be present the wounds healed by primary union. In two of the three there was a slight elevation of temperature (Figs 14, 15) otherwise convalescence was absolutely uneventful.

#### THE APPLICATION OF PRIMARY EXCISION AND SUTURE IN CIVIL PRACTICE

The surgeon in civil practice has several distinct advantages over the military surgeon. He usually has sufficient time with assistants and an equipment that will enable him to work to the best advantage. His cases come to him promptly after injury, rarely are they suffering from prolonged exposure to cold and

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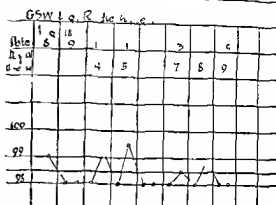


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dampness from extreme fatigue and hunger—important factors in the production of shock. On the other hand the wounds of civil life are frequently extensively lacerated and contused in contrast with the more sharply defined wounds caused by shrapnel and bullets *when there is no bone injury*. When the impact of shrapnel or bullet has been transmitted to bone causing a fracture and showering of bone fragments through the soft tissue the resulting condition in so far as the complete excision of damaged tissue is concerned presents much the same difficulties as the lacerated and contused wound of emergency and industrial surgery. In both cases the chief difficulty aside from anatomical considerations lies in determining the extent of injury and in removing all the damaged structures and tissues whose blood supply has been destroyed. With crushing wounds the surgeon will remember that the degree of injury is usually more extensive than may appear in the first few hours. The result of trauma to the blood supply appears gradually through 4 to 48 hours so that tissues which appear fairly normal at operation may show definite evidences of gangrene 24 hours later.

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to certain details is of especial importance. Adequate incisions with an exposure of the injured parts that will permit the operator to see clearly into every corner of the wound are absolutely essential to success. If the damaged tissues are completely excised an eight inch incision will heal as rapidly as one of four inches. If infected material is left behind a small incision will not be of avail. The use of a staining solution such as methylene blue or brilliant green as advised by LeGrand Wilson Hey and others may be of help in recognizing recesses of the wound that might otherwise escape attention. Complete control of hemorrhage and obliteration of all dead spaces without undue tension have been frequently shown to be of primary importance. Dispensing with the constrictor at the earliest possible moment will aid the operator in determining whether the tissues left behind have an adequate blood supply. The contraction of the stimulated muscles when the paralyzing effect of the constrictor has been removed will also help to show the vitality of the tissues.

In cases of doubt the procedure of loosely packing the wound after excision with gauze saturated with a 1:1000 flavine solution or with liquid paraffine and waiting for 48 to 72 hours before completinguture seem to us to be of distinct value. The dressing may be removed

in the operating room with all precautions 15 to 15 p.m. 48 or 72 hours after operation. If at that time there is no evidence of infection or necrosis a culture can be made from the depth of the wound and suture completed. If necrosis is evident in any part of the wound the necrotic tissue can be excised and suture completed or delayed for another 48 hours as the judgment of the operator may indicate. In doubtful cases such a course offers the advantages of primary excision and at the same time obviates the possibility of locking up infection in the depth of the wound. If cultures of the excised wound show hæmolytic streptococci to be present it is wiser to remove all sutures and sterilize the wound with Dakin's solution.

# SUMMARY

1. Of 116 flesh wounds treated by primary excision and suture at a base hospital on an average of 49.81 hours after injury 99 (85.3 per cent) were completely successful 11 (9.5 per cent) were partially successful 6 (5.2 per cent) were complete failures. Of the failures 5 were due to infection with hæmolytic streptococci.

Of 45 wounds complicated by a wide variety of bone joint nerve or tendon injuries operated upon after a similar interval of time 6 (57.7 per cent) were completely successful 17 (37.7 per cent) were partially successful 5 (11.1 per cent) were failures.

Of the total 77.6 per cent were completely successful 17.4 per cent were partially successful 5 per cent were failures.

3. Of 37 wounds excised at the front on an average of 16.5 hours after injury and sutured at the base 6.6 hours later 31 (83.8 per cent) were completely successful 3 (8.1 per cent) were partially successful 3 (8.1 per cent) were failures. The successful cases included 9 cases complicated by bone or tendon injury.

4. By careful attention to details of technique the writer feels that similar methods

may be applied in the treatment of wounds in civil practice with equal or still better results.

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## SECONDARY SYPHILIS OF THE UTERUS

By GEORGE GELLHORN M D FACS Sr LOUIS  
F m h G e n l g e a l S r v f W h g t U t t h St. Lo C y H o l

THE scarcity of literature on secondary syphilis of the cervix uteri justifies the publication of the following observation.

M H age 6 white is a prostitute of the clandestine variety. She has several friends and was arrested on the street while talking to a soldier. As the Wasserman test was found positive she was sent to the City Hospital for treatment on November 25, 1934. No. 1. She claims to be perfectly normal as high intelligence and her detention on clinical grounds is negligible. Diminished intelligence had a role in the abnormal genital three weeks and that she had some bur in her anus. She had had one or more in seven years.

The general reaction is negative. There is absolutely no clinical signs of syphilis upon her blood. In particular there are mucous patches in the mouth, no enlarged glands, no uveitis, no eruptions.

The gynecologic examination elicited the following. Uterus in the left iliac region near the clitoris is a fibromyomatous fibromyoma measuring 10 cm in diameter. The uterine cavity is normal. The endometrium is normal. The ovaries are normal. The cervix is normal. The vagina is normal. The rectum is normal. The sigmoid colon is normal. The appendix is normal. The lungs are normal. The heart is normal. The stomach is normal. The small intestine is normal. The large intestine is normal. The bladder is normal. The prostate is normal. The testes are normal. The epididymis is normal. The vas deferens is normal. The ureters are normal. The kidneys are normal. The adrenal glands are normal. The pancreas is normal. The gallbladder is normal. The biliary system is normal. The urinary system is normal. The reproductive system is normal. The endocrine system is normal. The immune system is normal. The nervous system is normal. The muscular system is normal. The skeletal system is normal. The integumentary system is normal. The sensory system is normal. The motor system is normal. The circulatory system is normal. The respiratory system is normal. The digestive system is normal. The excretory system is normal. The reproductive system is normal. The endocrine system is normal. The immune system is normal. The nervous system is normal. The muscular system is normal. The skeletal system is normal. The integumentary system is normal. The sensory system is normal. The motor system is normal. The circulatory system is normal. The respiratory system is normal. The digestive system is normal. The excretory system is normal.

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 i n t s l n g s d i a m e t e r l i c h i s b u t c e n t  
 m e t a b o v e t h e e t e r a l s T h s p a t c h a s v  
 s l i g h t l y u s e l a b i n t h e n e i g h o r i n g m u o a n d  
 h a d a n e l y g n u l r p n k h s u r f a c e A t t h e  
 c i r c u m f e n c a n l e i n d a l l t l e i t o t h p i t c h  
 i s s f r i n t l i o s h i s c o l o r a t i o n T o t h e r  
 s m i l l e a n d n r n a r l y o u d p a t c h s l a y t o t h e  
 r i g h t o f t h e l i n a n d a f o u r t h p a t c h w o u l d  
 b e s e e n u n o n t h s c o s s a i n t e r p l y A l l t h e s e  
 p a t c h e s f e l t o f t t h e t u h a n d b l e d e r y s l i g h t l y  
 w h e n r u l b e d t h c o t t n a r m o r e d a p p l e t r  
 T h e s e c r e t o n o f t h e p t c h e s e a m n e d t h t h e  
 u l t r a n c r o s c o p h l a n a n d n o u n c e o f v e r y  
 p i r o h i a o f t h t t l p l i d a v r u t y

Slides stained according to Fontana revealed the organism in large quantities.

The patient received an injection of salvarsan and energeticunctions together with potassium iodide internally.

On December 23, 1918 Dr. Lloyd Thompson of Hot Springs, Arkansas, an authority on syphilis and author of a recent book on the subject kindly examined the patient with me. He found a slight rigidity of the neck and groins, the left patellar reflex a trifle increased, the pupils a little sluggish. Oil of *Sassafras* was present in the speculum, the patches within the cervical canal were practically normal except that the color of the lower third was a deep red. The cervical secretion however was lessened and was tinged with blood. The spirochete could not be demonstrated by dark field illumination.

A second object on of saliva san was given and the mercury rub and got num iodide admira tra tt u c at med and on January 1 1909 the primar ls on up n the l b um minus had completely ds appea e l rly in Janu 3 I i ta en sic w b nfu n a and hen I resumed my work at the h spital I fou d the patient had been disch rged n k o l h e th but unfor tunately thout a final local e n n tion and I ha e b e r able to t t a e h r p e s at t h e a t o u t s

## EPICRYSIS

We have to deal in this instance with a fairly recent case of syphilis. The initial lesion in the vulva was still present but so far advanced toward resolution that the Wassermann test had had time to become positive. If we retain for the sake of convenience the old classification of Ricord we have to define the case as an early, a secondary lues. Strange to say the classical manifestations of the disease were altogether absent in particular cutaneous eruptions were lacking. There were however several patches upon the mucosa of the cervical canal which from their coincidence with the initial sclerosis and a positive Wassermann were highly suggestive of syphilis. The microscopic demonstration of large numbers of the procreta pallida in the secretion of these patches clinched the diagnosis.

Other lesions which might have to be considered could quickly be excluded. A diphtheritic patch would have been covered with a typical membrane. A cancerous ulcer would have bled easily in addition it would at this early stage have been solitary. A tuberculous ulcer would have presented a ragged appearance and a simple erosion would have occupied the outside of the vaginal portion but not the cervical canal.

Our case therefore is to be classed as one of secondary syphilis of the cervix uteri. The number of recorded cases of this kind is very small. In 1916 Ehrenfest and the writer<sup>1</sup> collected the entire available literature on the subject and added eight personal observations. Since then no new reports have appeared in print. Secondary manifestations of syphilis upon the cervix manifest themselves in the form of macules, papules and ulcerations. These forms probably represent three successive stages in the development of a lesion caused by scattered accumulations of the spirochæta in the squamous epithelium of the cervix. The parasite can readily be recovered from the secretion of any of the three forms and this explains the great infectiousness of secondary lesions. Wassermann is positive in this stage. Macules and papules have no symptomatology of their own while ulcers may give rise to profuse yellowish discharge. The whitish appearance of the macules, the slight elevation of the papules and the typical yellowish color of the ulcerations render diagnosis comparatively easy. Secondaries in other parts of the body form a valuable aid. Cervical lesions as a rule heal quickly and may disappear without leaving any traces. Specific treatment energetically applied brings about resolution in a very short time.

The present case differs from this general picture in several important particulars. Whereas in all previously known cases the lesion was situated upon the *outside* of the vaginal portion, this to my knowledge is the first instance where the specific affection could be demonstrated *within* the cervical canal.

There were no secondaries anywhere in the body and as the state of the primary lesion indicated the recent date of infection the intracervical ulcerations must be regarded as the first and only secondary manifestations of syphilis in our patient.

Finally the unusual resistance of the lesions to specific treatment deserves mention. Even after an injection of salvarsan and several weeks of mercury inunctions the size of the lesions was unchanged and spirochæta could still be found.

There is yet another important aspect of the case. In the paper previously referred to Ehrenfest and the writer studied the question of the infectiousness of the physiologic secretions of syphilitic women. We referred to an observation made by Mueller where a prostitute was suspected of infecting men with syphilis and was examined repeatedly but presented no luetic symptoms or lesions. Later Wassermann was found positive and the spirochæta was demonstrated in her menstrual and leucorrhœal discharges. Graefenberg too found in four cases living spirochæta in the secretion from the cervix. Two of his patients were pregnant, all four had condylomata lata on the vulva but no lesion upon the cervix. In 3 other women who had received specific treatment the spirochæta could not be found in the cervical secretions. Ehrenfest and the writer finally examined the cervical discharges in a large number of women and found the typical spirochæta in cases though in both the cervical secretions were quite clear and apparently normal. One of these patients had some months previously secondary lesions upon the cervix which healed under energetic treatment. We therefore felt justified in the conclusions that the normal secretions of syphilitic women may cause infection even in the absence of local specific manifestations.

In the light of the present observation however this conclusion may have to be modified. In our case the fortunate coincidence of a cervical tear permitted me to inspect the *inside* of the cervical canal and to find there the specific lesions with its rich supply of prochloræ. It is permissible to

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assume that in the cases mentioned above such lesions existed within the cervical canal but were invisible through the closed external os. Until further evidence to the contrary is obtained it will be safe to adhere to the old view that discharge contain infectious pyrochete only in presence of a local lesion.

#### SUMMARY

In a syphilitic woman with a very recent infection several ulcerated patches *within* the cervical canal constituted the first and

only manifestations of secondary syphilis. The discovery of these lesions was made possible by an elevation of the cervical lips due to an old tear. A large number of the spirochete pallidum could be demonstrated in the excretion of the patches. Secondary lesions of the cervix are quite rare. They have been found upon the outside of the vaginal portion and this is the first case on record where the lesion was located within the cervical canal.

## THE IMPORTANCE OF EARLY RECOGNITION OF SURGICAL CONDITIONS OF THE BILIARY PASSAGES

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EVERY surgeon through intensive study of living pathology endeavors to educate the profession to realize the importance of early intervention in the diseases of abdominal viscera which experience has shown cannot be benefited except by surgery. The ill effects of delay are unlimited. It is a matter of justice to both patient and surgeon that the internist advise early operation in conditions that fail to respond to treatment within a certain reasonable time.

As a matter of fact there are a number of conditions which as soon as the diagnosis is made demand surgery. Experience has proved this in cases without number. And if this be true for the disease itself how much more important is it for the complication which may arise as a result of the original condition.

There are few abdominal conditions which carry within themselves more potential mischief than diseases of the gall bladder and biliary tract. We believe the surgeon has a right to expect if not to demand the privilege of consultation in all suspected gall bladder cases before the patient's condition has become grave and before those complications set in which increase the difficulties of operation and threaten the life of the patient. It is essential not only to diagnose such condi-

tion but to recognize them early and to realize when medical treatment is futile.

The diagnosis of affections of the gall bladder is not always easy. Acute cholecystitis for example generally presents relief symptoms as part of the clinical picture. Even at the operating table the less astute or the inexperienced surgeon is not always able to recognize the presence of cholecystic disease. The normal blue appearance of the thin walled gall bladder may not be changed but serious infection may be in its contents and only awaiting a chance to invade the gall bladder wall.

Although clinically the picture of acute cholecystitis and its complications presents many variations there are a few common features which characterize the disorder. Physical examination together with a careful history should in the majority of instances make the diagnosis clear. Lightness of touch on the part of the examiner is essential to obtaining all the information that can be elicited by palpation. Examination for rigidity and tenderness should include both sides of the abdomen the left side first. In doubtful cases placing the tips of the index and middle fingers of the right hand gently over the gall bladder region while the patient takes a deep breath will often elicit tender-

ness that cannot be recognized otherwise. Further pressure often gives valuable information when the patient inhales deeply and holds the breath. Tenderness in this region however does not always result from the gall bladder alone. A high appendix an active duodenal ulcer torsion of the omentum circumscribed hæmorrhage into the head of the pancreas and other conditions will give signs that cannot always be differentiated. A clean cut history may help but even then errors creep in.

More than a decade ago Moynihan called attention to what may be regarded as premonitory symptoms of gall bladder disease. He laid especial stress on the fact that the earliest symptoms are referred not to the liver or gall bladder but to the stomach. The symptoms are a feeling of epigastric fullness weight or distress after eating relieved by belching and especially by vomiting. There is a distinct relationship to certain kinds of food. If no relief is obtained there results an increasing sense of tightness and finally acute pain which may be eased by loosening the garments or by bending the body forward. Heartburn and acid eructations also frequently form part of the history. During this postprandial discomfort the patient often notices a catch or pain in the right costal margin on taking a deep breath. Chilliness is also often a complaint. These attacks occur with more or less frequency increase in severity and the pain usually radiates to the back the right shoulder or the right arm. Vomiting of bile is common. Jaundice is generally not present during the attack but may or may not appear two or three days afterward. A light icterus at this time usually indicates that a small stone has successfully passed through the cystic duct and caused only a transitory stasis of bile as it traversed the papilla of Vater. It may however also indicate that the inflammatory process has extended into the common or hepatic ducts and that obstruction is due to swelling of these passages. Operation is especially indicated in this class of cases. Sooner or later a stone will fail to pass will lodge in the common duct and lead to acute or chronic obstruction of that canal.

No one will deny that acute cholecystitis with common duct obstruction is much more serious than uncomplicated cholecystitis. Operation with this complication added is not only more difficult but also more dangerous. Furthermore there is the danger to the head of the pancreas to be considered. In the acute form this may lead to fat necrosis in the chronic form to fibrosis and ultimately perhaps to pancreatic diabetes. These serious complications can only be forestalled by early treatment of the cholecytic disease. The operative mortality rises directly with the gravity of the superadded conditions. In acute cholecystitis the figure ranges from 1 per cent to 4 per cent when complicated with common duct obstruction it rises to 5 per cent and with pancreatic involvement it reaches 9 per cent. While on the subject of the pancreas it might be emphasized that cholecystitis is the most common cause of pancreatolymphangitis. Pancreatolymphangitis is the first stage of chronic pancreatitis. Not only is chronic pancreatitis in many cases directly attributable to cholecystitis but a large percentage of cases of acute pancreatitis is due to this condition. Indeed we might go farther and say that carcinoma of the head of the pancreas may have cholecystitis as an underlying cause in some instances. Small isolated carcinomatous nodules are met with in the head of the pancreas which in some instances are consequent upon a circumscribed hæmorrhage or focus of infection which undergoes organization. Finally carcinomatous transformation takes place in the remaining epithelium. Such a case came under our observation but a short time ago in a young woman 20 years of age.

She had complained of digestive disturbances for a year and attacks of pain well localized to the right hypochondrium. For several weeks before admission she had noticed a light icterus which gradually deepened until on admission it was fairly well marked. At operation the gall bladder was opaque grayish with slightly thickened walls. A hard mass as large as an English walnut was discovered in the head of her pancreas. It was dark brown and sharply outlined except in one place. It was excised and the gall bladder was also removed. Pathologically the gall bladder was of the ordinary type of chronic interstitial cholecystitis with slight superficial ulceration of the mucosa but

definite fibrosis and lymphocytic infiltration of its wall. The mass from the pancreas showed scar tissue pigmented with hemosiderin, the sort of capsule nearly encircling it. Remnants of pancreatic structure were imbedded in the scar tissue. At one point there was a fragment of normal pancreatic tissue and into this were streaming epithelial cells in atypical clumps and chains, very definitely invasive and hence carcinomatous.

Pancreatic cysts may also be due directly or indirectly to spread of infection from cholecystic disease.

These are only some of the possibilities which should be taken into consideration when counseling delay in operation for gall bladder disease. To the surgeon these show either in acute or chronic gall bladder disease that an operation upon the biliary passages is not complete until the pancreas is thoroughly examined.

Surgeons do not often have the opportunity of meeting gall bladder cases in which the pathological change is a simple one. If the bacterial infection has been of low virulence and the resistance of the patient is good the attack may subside and both practitioner and patient are deceived into false reliance on the appearance of rectitude. Surgeons see acute exacerbation or acute inflammations implanted on a chronic process. These acute inflammations have been compared to those which occur in the appendix but they usually show much more of a phlegmonous character. The extent of the destructive process seen at operation is proof convincing that early surgery is the rational treatment for acute cholecystitis. Among these destructive processes and complications are gangrene with general sepsis, perforations with local or generalized peritonitis and varying degrees of cholangitis. These are fortunately not the more common conditions but they occur sufficiently frequent unfavorably to influence the prognosis in many cases.

From the standpoint of gross and microscopic pathology we have met in the last 1000 cases 60 gangrenous gall bladders. Twenty-six have shown acute lesions only. The remaining 130 acute cases have had chronic lesions as well. We recognize in the acute variety a simple inflammation involving

particularly the mucosa. The submucosa takes part to a less extent and the other coats show minor lesions. The changes in the mucosa amount to a cloudy swelling and mucoid degeneration of the epithelium with occasional dequamation. In the other coats there is a varying amount of edema, moderate active congestion and perhaps slight cellular exudation of polymorphonuclear leucocytes, a few eosinophiles and lymphocytes. In our experience this condition was seen only seldom. Most gall bladders when acute have shown far more extensive lesions. There have been varying degrees of the following changes in the mucosa: ulceration in the other coats, edema and diffuse polymorphonuclear infiltration. Our name for these is acute diffuse suppurative cholecystitis and we add as occasion demands with abscess formation or with abscess formation and gangrene. Unfortunately enough the latter diagnoses had to be made very frequently.

To repeat what has so often been contended a gall bladder once diseased never returns to its normal condition. If the patient recovers from the primary acute cholecystitis through non-surgical treatment, in even low grade infection with perhaps insufficient biliary drainage will lead to a chronic cholecystitis. Occasionally other conditions result such as empyema or hydrops.

Pathologically in both calculi and non-calculi chronic cholecystitis our experience has shown that in an overwhelming majority of cases all the coats of the gall bladder are involved. In the mucosa there is congestion, swelling, desquamation and increase in the amount of mucus. Lipoid changes occur in which lipoids and cholesterol are deposited in the mucosa and the submucosa. The deposits give a speckled yellow appearance grossly and the name strawberry gall bladder has been applied. This material comes from disintegration of cells and is seen quite commonly. Very often small crystalline masses of cholesterol or lipid are surrounded by foreign body giant cells. We do not attach any very special significance to strawberry gall bladders. The same condition may occur in other gall bladders and

chance may prevent deposition in this particular way. Ulceration superficial sometimes deep is very frequent. The ordinary chronic inflammatory changes namely fibrosis and lymphocytic infiltration are present in varying degree. These changes involve submucosa muscularis and peritoneum. We hold that these interstitial changes are more important than changes in the mucosa. They show how infection spreads from the interior of the gall bladder to the peritoneum. They explain the adhesions which surround the organ and envelop and involve neighboring viscera. Dense peritoneal sheets often cover the pylorus the duodenum the hepatic flexure of the colon great omentum or even the tip of the appendix. The normal regional anatomy is often completely obscured. It is often impossible to separate this vicious conglomerate mass with ordinary surgical instruments and we are either forced to run the risk of the severe trauma that would result from separating the mass or let it remain and do what we can in some other way to alleviate the sufferings of the patient.

In long standing cases the gall bladder is often atrophic in others it may be distended and filled with thick mucus sometimes bile stunted and sometimes when the normal function of the organ has long been lost no trace of bile is present. Gall stones were present in about 70 per cent of cases. Their presence adds insult to the already existing bacterial injury. Hyperplastic and proliferative changes occur and there are types in which the epithelium shows changes which might be regarded as precancerous. Actual primary carcinoma has occurred in 7 of our cases and gall stones were present in 5 of these.

The clinical symptoms of chronic cholecystitis may be very varied. Such things as the pressure and pull of adhesions on surrounding viscera the mechanical action of gall stones in causing the bladder to elongate with subsequent tension and traction on sensory nerves all serve to complicate the history. There are presented features of gastric and intestinal disturbances pylorospasm and spastic constipation. The severity of the special attacks which are referable directly to the gall bladder often decreases as the

condition becomes more chronic. This is very apt to be considered a sign of improvement. Quite the contrary. The gall bladder gradually loses its power of contraction owing to induration of its walls and adhesions cause symptoms referable to other viscera to come into the foreground. When acute exacerbations occur and when gall stones migrate to the common duct attacks more or less typical occur. Colic like localized pain vomiting fever jaundice local resistance and tenderness are then the predominant symptoms.

Medical treatment of the disorder can and often does effect a certain degree of improvement and relief of symptoms. It cannot bring about a cure it cannot reach the actual site of the trouble. Neither drugs nor the waters of so called cures Carlsbad or others can remove the stones nor can they bring the gall bladder back to normal. These cures so far as they regulate the life of the patient and provide for free elimination of toxic material are of temporary value in bringing about a period of latency. But the quiescent and latent gall bladder is not to be trusted! Sooner or later the consequences of lingering infection will make their appearance an acute exacerbation will occur and the patient will be just that much worse off than before. The immediate risks of chronic cholecystitis are much the same as those already mentioned in connection with the acute variety. Unfortunately we have no horoscope at our command to enable us to foretell which cases will and which will not develop complications such as perforation peritonitis obstruction of the common or cystic ducts induration of the head of the pancreas with its train of possibilities carcinoma of the gall bladder and so on.

From a study of selected specimens it is possible to reconstruct a more or less complete picture of what occurs in advancing disease of the gall bladder. The first changes are referable to the mucosa and consist of cloudy swelling and mucoid degeneration. Fatty degeneration and lipid changes then make their appearance. Coincidentally there is congestion edema and cellular infiltration of the walls. Desquamation occurs and then

ulceration. If the infection is more virulent the entire mucosa is destroyed and the walls are thickened with a dense pus cell infiltration, a large amount of œdema and quantities of fibrin. Petechial hæmorrhages occur. A further stage will show the pus cells gathered together in larger or smaller abscesses and finally gangrene will make its appearance. These specimens are often perforated. The peritoneum is covered with thick plastic exudate. If the infection is overcome before gangrene has occurred very rarely if it is present organization tissue makes its appearance, grows older, contracts and thickens the walls, leaving them less elastic, opaque and much less resistant to subsequent re-infection. The mucosa is replaced more or less completely. Infection however usually lingers and does not completely disappear. In addition small masses of mucus desquamated cells and bacteria will have formed a nidus for the formation of gall stones. Their irritation plus the irritation of the low grade infection induces more mucoid changes, more desquamation and thus a vicious circle is completed. The irritation leads to an ever increasing slow fibrosis. The epithelium may become hyperplastic and small villous like projections will appear covered by a more or less degenerated epithelium. As the gall stones increase in number and size their irritative effects are multiplied. Deep scarred ulcerations and ridges appear in the positions on which they press on the gall bladder. Connective tissue grows around them until they may lie in a definite pocket. If a stone becomes impacted in the cystic duct or in the neck of the gall bladder the accumulation of debris will cause a distention of the viscus with thinning of its walls, destruction of the mucosa and flattening of the scarred tissue. The muscularis disappears almost entirely and a large palpable tumor may be recognized clinically. The changes in the epithelium which are sometime papilloma

like have led to classifications such as papillomatous cholecystitis. While we are not in sympathy with such detailed classifications which only tend to confuse and render comparisons and statistics difficult, we do recognize that conditions covered by that term may have sinister possibilities. Carcinoma can and does arise from epithelium which has been subjected to long continued irritation and this possibility in connection with the gall bladder is ever present. Under some circumstances when the inflammatory process continues sufficiently long the gall bladder may gradually shrink with contraction of the scar tissue until it becomes nothing but a small fibrous sac deeply embedded in adhesions and filled with clove picked gall stones. At any time an acute exacerbation may occur and then the process outlined in the description of the acute form will be engrafted on the chronic one.

Early operation in chronic cholecystitis is comparatively simple. The end results are 95 per cent satisfactory as far as complete cure is concerned. But when the bile passages are involved we are confronted with a procedure which ranks high among technically difficult operations and the end results are less satisfactory. When the pancreas is involved the outlook for permanent relief is much obscured, the hopelessness of carcinoma of the bile passages needs nothing more than to be mentioned.

The importance of early recognition of surgical conditions of the bile passages is obvious. The history together with careful physical examination are the most reliable guides to a diagnosis. Laboratory procedure and X-ray findings when properly interpreted are valuable adjuncts. When the diagnosis is made the treatment is surgical. The complications and sequelæ which have been presented in brief outline are too constant and too grave to allow any other but this procedure.

## A CONTRIBUTION TO THE STUDY OF "STIFF AND PAINFUL SHOULDER"

BY ALFRED J. BROWN, M.D., F.A.C.S., OMAHA, NEBRASKA

THE classification of the pathologic lesions causing the condition which may perhaps best be defined as stiff and painful shoulder appears as yet incomplete. Experience has shown that many different lesions cause the symptom complex included in the above term. These have been carefully studied and minutely described by various observers. There remain a certain number of cases which do not seem to fit into the classification thus far made. The pathologic lesions appear to be of a different type and they do not yield to the therapeutic measures advocated for the various types of injury. It would appear therefore that there are etiologic and pathologic factors which do not comply with those thus far described that will give rise to stiff and painful shoulder. It will be the object of this paper to suggest that a tear of the tendons of the latissimus dorsi and teres major muscles may play an important role in the etiology of some of the cases of stiff and painful shoulder and also to point out certain therapeutic indications in the disability caused by this lesion.

Because of the frequency of stiff and painful shoulder after comparatively mild trauma and its resistance to ordinary therapeutic measures the subject has been one which has aroused considerable interest for many years. It was at first classed as a brachial neuritis or a circumflex palsy. These conditions do occur but as a rule the causative trauma is more severe and the symptoms are so much more definite than those of the ordinary type of the disability that careful examination for true nerve lesions will reveal their presence and thus serve to differentiate the two conditions. The same is true in the differentiation of the more severe injuries of the shoulder such as fractures of the greater tuberosity of the humerus, fracture of the clavicle or of the scapula. In these the diagnostic signs are definite and resort to the X-ray will establish the diagnosis.

The masterly paper of Codman discussing the subject of stiff and painful shoulder directed the attention of surgeons to the frequency and importance of the condition and the necessity for its careful study. He called attention to inflammation following trauma of the subacromial or better called subdeltoid bursa as a causative factor in stiff and painful shoulder and in a later publication to the frequent occurrence of a small tear in the tendon of the supraspinatus muscle accompanying the inflammation of the bursa. Brackner has contributed largely to the subject and thrown valuable light on many obscure points. Other observers have studied various points in pathology, diagnosis and treatment. For a more or less complete review of the literature of the subject the reader is referred to the bibliography accompanying this paper.

## SYMPTOMS

Stiff and painful shoulder presents a more or less classical picture. After a moderate trauma of a rather definite type usually a fall in which the patient puts out his arm to save himself or a wrench of the shoulder caused by a sudden motion while the arm is abducted as while hanging on a strap in a street car or a sudden muscular effort as pitching a base ball before the muscles are accustomed to the required motion after such a trauma the patient feels a snap in the shoulder followed by a severe sharp pain and in some cases the arm falls almost helpless by the side. Motion of the arm is extremely painful especially the movement of abduction and that of external rotation when this is carried out with the arm in a position of moderate abduction. Because of the pain the arm is carried in the sling position and a moderate amount of atrophy of the deltoid muscle supervenes in a rather short time giving the appearance of a nerve involvement. The pain is present constantly in some cases.



ulceration. If the infection is more virulent the entire mucosa is destroyed and the walls are thickened with a dense pus cell infiltration. A large amount of oedema and quantities of fibrin. Petechial hæmorrhages occur. A further stage will show the pus cells gathered together in larger or smaller abscesses and finally gangrene will make its appearance. These specimens are often perforated. The peritoneum is covered with thick plastic exudate. If the infection is overcome before gangrene has occurred very rarely if it is present organization tissue makes its appearance grows older contracts and thickens the wall leaving them less elastic opaque and much less resistant to subsequent re-infection. The mucosa is replaced more or less completely. Infection however usually lingers and does not completely disappear. In addition small masses of mucus desquamated cells and bacteria will have formed a nidus for the formation of gall stones. Their irritation plus the irritation of the low grade infection induces more mucoid changes more desquamation and thus a vicious circle is completed. The irritation leads to an ever increasing slow fibrosis. The epithelium may become hyperplastic and small villous like projections will appear covered by a more or less degenerated epithelium. As the gall stones increase in number and size their irritative effects are multiplied. Deep carried ulcerations and ridges appear in the positions on which they press on the gall bladder. Connective tissue grows around them until they may lie in a definite pocket. If a stone becomes impacted in the cystic duct or in the neck of the gall bladder the accumulation of debris will cause a distention of the viscus with thinning of its wall destruction of the mucosa and flattening of the scarred tissue. The muscularis disappears almost entirely and a large palpable tumor may be recognized clinically. The changes in the epithelium which are sometimes papilloma

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## SYMPTOMS

Stiff and painful shoulder presents a more or less classical picture. After a moderate trauma of a rather definite type usually a fall in which the patient puts out his arm to save himself or a wrench of the shoulder caused by a sudden motion while the arm is abducted as while hanging on a strap in a street car or a sudden muscular effort as pitching a base ball before the muscles are accustomed to the required motion after such a trauma the patient feels a snap in the shoulder followed by a severe sharp pain and in some cases the arm falls almost helpless by the side. Motion of the arm is extremely painful especially the movement of abduction and that of external rotation when this is carried out with the arm in a position of moderate abduction. Because of the pain the arm is carried in the sling position and a moderate amount of atrophy of the deltoid muscle supervenes in a rather short time giving the appearance of a nerve involvement. The pain is present constantly in some cases

ulceration. If the infection is more virulent the entire mucosa is destroyed and the walls are thickened with a dense pus cell infiltration. A large amount of oedema and quantities of fibrin. Petechial hemorrhages occur. A further stage will show the pus cells gathered together in larger or smaller abscesses and finally gangrene will make its appearance. These specimens are often perforated. The peritoneum is covered with thick plastic exudate. If the infection is overcome before gangrene has occurred very rarely if it is present organization tissue makes its appearance. As the gall bladder grows older contracts and thickens the walls leaving them less elastic opaque and much less resistant to subsequent re-infection. The mucosa is replaced more or less completely. Infection however usually lingers and does not completely disappear. In addition small masses of mucus desquamated cells and bacteria will have formed a nidus for the formation of gall stones. Their irritation plus the irritation of the low grade infection induces more mucoid changes more desquamation and thus a vicious circle is completed. The irritation leads to an ever increasing slow fibrosis. The epithelium may become hyperplastic and small villous like projections will appear covered by a more or less degenerated epithelium. As the gall stones increase in number and size their irritative effects are multiplied. Deep scarred ulcerations and ridges appear in the positions on which they press on the gall bladder. Connective tissue grows around them until they may lie in a definite pocket. If a stone becomes impacted in the cystic duct or in the neck of the gall bladder the accumulation of debris will cause a distention of the viscus with thinning of its walls destruction of the mucosa and flattening of the scarred tissue. The muscularis disappears almost entirely and a large palpable tumor may be recognized clinically. The changes in the epithelium which are sometimes papilloma

like have led to classifications such as papillomatous cholecystitis. While we are not in sympathy with such detailed classifications which only tend to confuse and render comparisons and statistics difficult we do recognize that conditions covered by that term may have sinister possibilities. Carcinoma can and does arise from epithelium which has been subjected to long continued irritation and this possibility in connection with the gall bladder is ever present. Under some circumstances when the inflammatory process continues sufficiently long the gall bladder may gradually shrink with contraction of the scar tissue until it becomes nothing but a small fibrous sac deeply embedded in adhesions and filled with closely packed gall stones. At any time an acute exacerbation may occur and then the process outlined in the description of the acute form will be engrafted on the chronic one.

Early operation in chronic cholecystitis is comparatively simple. The end results are 95 per cent satisfactory as far as complete cure is concerned. But when the bile passages are involved we are confronted with a procedure which ranks high among technically difficult operations and the end results are less satisfactory. When the pancreas is involved the outlook for permanent relief is much obscured the hopelessness of carcinoma of the bile passages needs nothing more than to be mentioned.

The importance of early recognition of surgical conditions of the bile passages is obvious. The history together with careful physical examination are the most reliable guides to a diagnosis. Laboratory procedure and X-ray findings when properly interpreted are valuable adjuncts. When the diagnosis is made the treatment is surgical. The complications and sequelae which have been presented in brief outline are too constant and too grave to allow any other but this procedure.

## A CONTRIBUTION TO THE STUDY OF STIFF AND PAINFUL SHOULDER

BY ALFRED J. BROWN, M.D., F.A.C.S., OMAHA, NEBRASKA

THE classification of the pathologic lesions causing the condition which may perhaps best be defined as stiff and painful shoulder appears as yet incomplete. Experience has shown that many different lesions cause the symptom complex included in the above term. These have been carefully studied and minutely described by various observers. There remain a certain number of cases which do not seem to fit into the classification thus far made. The pathologic lesions appear to be of a different type and they do not yield to the therapeutic measures advocated for the various types of injury. It would appear therefore that there are etiologic and pathologic factors which do not comply with those thus far described that will give rise to stiff and painful shoulder. It will be the object of this paper to suggest that a tear of the tendons of the latissimus dorsi and teres major muscles may play an important role in the etiology of some of the cases of stiff and painful shoulder and also to point out certain therapeutic indications in the disability caused by this lesion.

Because of the frequency of stiff and painful shoulder after comparatively mild trauma and its resistance to ordinary therapeutic measures, the subject has been one which has aroused considerable interest for many years. It was at first classed as a brachial neuritis or a circumflex palsy. These conditions do occur but as a rule the causative trauma is more severe and the symptoms are so much more definite than those of the ordinary type of the disability that careful examination for true nerve lesions will reveal their presence and thus serve to differentiate the two conditions. The same is true in the differentiation of the more severe injuries of the shoulder such as fractures of the greater tuberosity of the humerus, fracture of the clavicle or of the scapula. In these the diagnostic signs are definite and resort to the X-ray will establish the diagnosis.

The masterly paper of Codman discussing the subject of stiff and painful shoulder directed the attention of surgeons to the frequency and importance of the condition and the necessity for its careful study. He called attention to inflammation following trauma of the subacromial or better called subdeltoid bursa as a causative factor in stiff and painful shoulder and in a later publication to the frequent occurrence of a small tear in the tendon of the supraspinatus muscle accompanying the inflammation of the bursa. Brackner has contributed largely to the subject and thrown valuable light on many obscure points. Other observers have studied various points in pathology, diagnosis and treatment. For a more or less complete review of the literature of the subject the reader is referred to the bibliography accompanying this paper.

## SYMPTOMS

Stiff and painful shoulder presents a more or less classical picture. After a moderate trauma of a rather definite type, usually a fall in which the patient puts out his arm to save himself or a wrench of the shoulder caused by a sudden motion while the arm is abducted as while hanging on a strap in a street car or a sudden muscular effort as pitching a base ball before the muscles are accustomed to the required motion, after such a trauma the patient feels a snap in the shoulder followed by a severe sharp pain and in some cases the arm falls almost helplessly to the side. Motion of the arm is extremely painful especially the movement of abduction and that of external rotation when this is carried out with the arm in a position of moderate abduction. Because of the pain the arm is carried in the sling position and a moderate amount of atrophy of the deltoid muscle supervenes in a rather short time, giving the appearance of a nerve involvement. The pain is present constantly in some cases.

and extends from the shoulder down the inner and outer sides of the arm to the elbow and in more severe cases even to the wrist and hand. Pain is accentuated by motion and more by active than passive motion. There is however as Codman has shown a small range of motion amounting to about 10 degrees which is not painful. This is due to the fact that within this range the injured muscle is not placed on the stretch and consequently are not further traumatized. This symptom serves as a point of differentiation between extra articular and intra articular lesion of the shoulder for in the latter where joint surfaces are involved pain occurs at the very beginning of joint movement. The condition easily becomes chronic and tends to recur after minor trauma.

Examination of the shoulder seems at first sight to reveal very little of a definite nature. There is as a rule some tenderness beneath the tip of the acromion process the patient showing in extreme disinclination to move the arm. There is a resistance to passive motion beyond an arc of 10 to 15 degrees. According to the length of time the disability has existed there is a certain amount of atrophy of the deltoid muscle and as time goes on the atrophy becomes more marked than an atrophy that can be attributed to disuse alone. In the cases of the type under discussion in this paper there is a point of tenderness on the inner surface of the humerus high up in the axilla. This sign has been noted by Brickner and he speaks of the difficulty of assigning a definite cause for it.

These symptoms may be taken as typical of a stiff and painful shoulder. Except for the atrophy of the deltoid which does not come on at once and the presence of a tender spot in the axilla there appear to be no points of diagnostic difference between the form under discussion and that due to many other forms of lesion. It is necessary therefore to consider the other forms of lesion and these being discarded seek further for a causative factor. The main forms of disability of the shoulder may be classified as follows:

- 1 Brachial neuritis
- 2 Intra articular lesions including luxations

- 3 Fractures
  - a Of the humerus including the greater tuberosity
  - b Of the scapula including the acromion process and small splits of the glenoid rim or separation of the glenoid ligament
  - c Of the outer part of the clavicle
- 4 Lesions of the head of the humerus (tuberculosis syphilis neoplasm)
- 5 Spontaneously reduced dislocations
- 6 Bursitis coracobrachial or subdeltoid
- 7 Injury to the supraspinatus tendon
- 8 Lesser tear of the capsule of the joint by sprain

After the above conditions have been ruled out by careful examination there remain a number of cases which do not fit in to any of the diagnoses suggested. These cases present the symptoms as outlined above and resemble closely cases of subdeltoid bursitis. They present a point of marked tenderness on the inner surface of the humerus high up in the axilla and in cases of moderate standing a more marked atrophy of the deltoid than can be explained by disuse alone.

#### MECHANISM OF CAUSATION OF THE TEAR

In cases of stiff and painful shoulder from this cause one is struck by the remarkable similarity of the trauma in many cases. The patient states that he grasped a fly in his hand in a gymnasium or was hanging to a strap in a car and the car gave a sudden lurch or he felt he was about to fall and threw down his arm to save himself or was pitching a baseball and felt something give in his shoulder. In all cases the predominant factor is a sudden sharp adduction of the humerus either in the form of a reflex contraction stopping unexpected abduction or a suddenly applied muscular overstrain as in pitching an incurve or a high straight ball which bounces into play sudden snappy adduction together with internal rotation. In all these motions the muscles thrown into sudden action are the teres major and latissimus dorsi which contract with great violence in order to prevent the sudden and unexpected abduction. When we consider in addition that in any muscular action the primary contraction

occurs first and most forcibly in the antagonistic group of muscles we see that in the motion of abduction the *teres major* and *latissimus dorsi* are already contracted as a result of this law. Now add a very sudden overstrain to prevent further abduction and a double force is suddenly placed on the muscle and tendon fiber. Further in a sudden motion the muscular contraction is less controlled than in one that is slow and well coordinated and instances of tear of tendon or muscle fiber or even fracture of bone from suddenly applied muscular force are not infrequent. In the shoulder Codman has called attention to the frequency and importance of tear of the *supraspinatus* tendon due to muscular violence suddenly applied and attributes to it the main cause of the disability in many cases of injury to the shoulder. His findings have been substantiated by many other observers. There is a great similarity in the form of the tendon of the *supraspinatus* and that of the tendons of the *latissimus dorsi* and *teres major*. All are thin, flat and spread out over the bone at their insertions and are tendons of powerful muscles. Also they are bound to the bone or to one another (in the case of the *latissimus dorsi* and *teres major*) by thin connective tissue which beneath the tendon is closely attached to the periosteum. The sudden application of muscular force to tendons of this character will result in a tear of the tendon fibers close to the point of insertion and a tear of the small connective tissue and periosteal fibers which hold the tendons flat against the bone.

#### PATHOLOGY

There occurs as a result of the tear of the tendon a small hemorrhage at the site of injury and later an exudation of serum with the usual oedema and later phenomena of the process of repair. This extravasation in the tendon and beneath the periosteum places the latter on the stretch and makes it tender on pressure and on movement of the arm. If allowed to run its own course the lesion heals, provided motion is interdicted and the final result is a firm non-vascular scar which gives rise to pain with every movement of abduc-

tion. If motion is persisted in during the attempt at repair every attempt at abduction of the arm is accompanied by severe pain due to tearing of the reparative tissue. As a result repair is very slow and when it does occur is insecure.

The extravasation and oedema passing into the tissues of the axillary space is directed by the arrangements of the fascial planes into the quadrilateral space between the inner surface of the humerus upper border of the tendon of the *teres major* outer border of the long head of the *triceps* and lower border of the *subscapularis*. There it encounters and presses on the main trunk of the circumflex nerve as it passes backward through this space and winds around the humerus to supply the deltoid muscle and the skin over the shoulder. This nerve is involved secondarily in the inflammatory process and thus the symptoms of pain over the point of the shoulder on motion and a greater amount of atrophy than can be attributed to disuse ensue as the result of the partial disabling of the function of the nerve. In more severe cases with a greater amount of effusion the *musculospiral* nerve which lies in close apposition to the circumflex is involved and gives rise to pain along the course of the internal and external sensory branches which supply sensation to the sides of the arm as far as the elbow.

The condition is apt to recur after slight trauma for the following reason especially in a neglected case. Healing results in a weakened scar poorly supplied with blood which has formed under constant irritation applied by the movements of the arm. Any trauma will therefore cause a tear at the site of the scar. In more severe cases in which the patient has held the arm in the sling position the scar tissue may involve the circumflex nerve and give rise to permanent impairment of its function. The scar may also be such as to cause permanent shortening and disability of the muscle.

The condition as outlined above is similar to well known occurrences in other joints such as sprained ankle with the addition of a few peculiar factors governed by the anatomical relations of the structures involved.

Robert Jones has so well summarized the general principles of strains of muscular attachments around joints that quotation at length is here given

Strains of muscular attachments about joints often give rise to serious impairment of function. From incomplete diagnosis these conditions are often inefficiently treated. They are diagnosed by the fact that there are certain movements that the patient cannot perform because he is suddenly pulled up by pain which he localizes fairly exactly at some point about a joint. Careful testing of the movement which hurts will generally prove that active contraction against resistance or passive stretching of a certain group of muscles causes the pain. Further careful palpation will find a tender spot just at the attachment of a tendon over an area no bigger than a sixpence and a little swelling. If a suggestion of edema or fluid may be felt deep down on the surface of the bone. This tender spot is the key to the situation. It is a small patch of effusion below the periosteum on the fibers of the tendon which run in and through the periosteum to the bone constituting the origin or insertion of the muscle.

The pains due to tension on this effusion caused by tension on the muscle or by direct pressure on the edematous spot.

Such an injury may be acute in type as in from a single sudden wrench stretching a tendon or otherwise loosening the trochanteric tendinous plexus; it may be subacute arising from repeated smaller injuries as in the familiar tennis and golf elbows; or either of these may pass on to a chronic state in which it is dormant and liable to become acute on any provocation and this chronic state may continue for weeks or months before the patient is taken part in active pursuits. The reason why this kind of injury is often so long continued and troublesome is that excessive tension is put on the muscle as a fresh acute inflammation in the injured tissues and the repeated injury maintains the effusion and prevents repair of the stretched or torn fibers.

Three types of stiff and painful shoulder due to a tear in the tendons of the teres major and latissimus dorsi tendons can be recognized which depend upon the length of time the condition is discovered after the injury: the acute type, the subacute and the chronic. The etiologic factor in all is a suddenly applied trauma. Immediately after the trauma during the stage of exudation the acute type presents the symptoms given above. During the process of repair and before the formation of firm scar tissue we have the subacute type which presents the great liability to relapse after slight trauma and after the formation

of a firm scar with the concomitant adhesions we have the third or chronic type with the almost useless arm.

#### DIAGNOSIS

Careful examination of an injured shoulder is essential for a correct diagnosis. Accurate tests of motion should be made to establish the muscles which are placed upon the stretch when pain is caused by motion both active and passive. It will be found that in many cases of stiff and painful shoulder abduction is accompanied by exquisite pain and this will be increased by external rotation of the arm carried on while the arm is in the abducted position. Points of tenderness should be looked for. A point of tenderness on the inner surface of the humerus high up in the axilla will be found in the type of lesion under consideration. Further examination of this tenderness made by placing the thumb on the anterior surface of the teres major tendon near its insertion in the bone and the fingers behind the tendon will show that the point of tenderness can in many cases be localized in a small definitely circumscribed area of the tendon which is usually found just at the point where the tendon is inserted into the bone.

Careful examination should be made to exclude other forms of joint disability. In all cases it is well to have a roentgenogram of the joint and surrounding bony structures and wherever facilities permit a stereoscopic roentgenogram will be found of more value than a view in one or two planes.

In the subacute and chronic types an atrophy of the deltoid muscle greater than that caused by disuse alone and yet in which no gross lesion of the circumflex nerve can be demonstrated will point to an interference with the function of the nerve by inflammatory products following a tear of the tendon fibers.

The three significant signs which point to a disability due to a tear of the fibers of the teres major and latissimus dorsi tendons, other conditions being ruled out by careful examination are

1. Pain when the involved muscle are placed on the stretch by the motion of abduction.

tion and external rotation in the abducted position

2 A definite point of tenderness in the tendons of the muscles at or near their attachment to the bone

3 In the subacute or chronic cases atrophy of the deltoid muscle greater than that from disuse occurring without demonstrable gross nerve lesion

#### TREATMENT

This may be divided into three types according to the stage of the condition when first seen whether acute subacute or chronic

In the acute stage which is encountered immediately after the receipt of the injury and the onset of the symptoms the shoulder will do better with rest in such a position that the torn edges of the tendon will remain in apposition. This will be the sling position. Active motion may be begun the day following injury in definite periods of 15 minutes each carried out 3 or 4 times a day. Active motion should always be kept within the limits of pain. Splinting the muscle is recommended by Jones cannot be carried out in this condition because of the anatomical arrangement of the muscles injured but splinting the deltoid by an adhesive plaster strip placed tightly across the muscle at right angles to the direction of its fibers just above its insertion into the humerus will inhibit abduction and so lessen the danger of stretching or tearing the involved tendons.

As the object of treatment is to accomplish early absorption of the extravasation and subsequently bring about the formation of a scar with a good blood supply massage will be found of great value. The massage in acute cases should be gentle and in the main directed to the injured part. General massage of the surrounding muscles may be used to advantage to keep up their tone during the period of inactivity and to guard against the development of local myositis which is apt to occur in muscles which have been subjected to trauma and then are allowed to remain inactive. Massage should be used duly or best performed by the surgeon himself or by a trained masseur should always be gentle and kept within the limits of pain.

In the acute stage then the treatment consists in immobilization for a short time active motion begun early for short periods and always within the limits of pain prevention of new insults to injured or reparative structures by splinting the deltoid and inhibiting motion tending to cause such insult (for any motion which does not cause pain may be freely used and will serve to keep up muscle tone) and local and general massage intelligently employed.

In the subacute stage the treatment is essentially the same as in the acute except for the immobilization. In this stage the patient is best encouraged to use the shoulder as much as possible but always within the limits of pain. A little time taken in the examination of this type of shoulder will discover movements which can be performed without pain. These motions should be pointed out to the patient and he should be encouraged to practice such movements faithfully. Massage should be used and may be more vigorously applied as the object in this stage is to promote a new blood supply in scar tissue which is at least partly formed—a more difficult process than where the reparative tissue is forming as in the acute condition.

In the chronic and more severe cases it is necessary first to break up the firm scar and fibrous tissue which has formed in the tendons and the adhesions which have formed in the surrounding villary tissues also to overcome the shortening of the muscles which has taken place as the result of carrying the arm in the sling position for a considerable length of time. This is best accomplished as recommended by Codman by breaking up the adhesions under an anesthetic. This transforms the condition to one comparable to a case in the acute stage and it should be treated accordingly.

#### SUMMARY

1 Stiff and painful shoulder of a certain type falls into the general class of muscular strain about joints and this muscular strain centers itself in the tendons of the *teres major* and *latissimus dorsi* muscles.

The condition manifests itself in (1) pain produced by stretching the injured



muscles (b) a distinct localized point of tenderness over the site of injury in the tendon and at its attachment to the bone and (c) early development of a moderate amount of atrophy of the deltoid muscle due to the involvement of the circumflex nerve in the inflammatory and reparative processes

3 The condition is amenable to treatment along lines which have proved successful in similar conditions in other parts of the body. This treatment is conservative and is directed toward (a) prevention of trauma (b) hastening of resolution of edema and exudative processes and (c) the formation of a pliable point of union by means of well vascularized connective tissue

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## ON THE PRESENCE OF ADRENAL RESTS IN THE WALLS OF HERNIAL SACS

BY ALEXANDER MACLENNAN M.B. C.M. GLASGOW SCOTLAND

H. R. S. Geo. R. J. Hosp. t. l. f. S. k. Ch. M. Glasg. w. n. ry. C. l. t. g. S. g. St. I. Roy. I. l. f. m. ry. C. l. t. g. S. g. C. ty. C. l. f. L. n. k. h. r. e. C. l. t. S. g. Gl. g. w. l. th. East. C. o. t. R. i. y.

**D**URING the last four and a half year almost 700 radical cures for hernia have been performed by me at the Royal Hospital for Sick Children. In six of these cases small nodules previously noticed on several occasions have been submitted to microscopic examination. In one case a typical nodule was lost. In one child a nodule was found on each sac of a bilateral inguinal hernia. Since attention has been drawn to these little particles they are being observed with increasing frequency the proportion up to the present works out at 1 per cent.

These nodules are minute, not being larger than  $\frac{1}{8}$  inch in diameter, practically all have been of the same size. They are embedded in the wall of the sac near, but not attached to the cord. They appear as brownish yellow flattened spherical particles having a pearly appearance. They require to be differentiated from fat lobules which they superficially resemble. So far only one nodule has been detected on each sac. Once the nodule was found loose inside the sac but doubtless it had become displaced there as the sac had been widely opened during its isolation. These fragments are also readily detached from the

sacs. The sacs on which these rests have been found have been with one exception typically so called acquired ones, the exception being a congenital hernia, i.e. one where the tunica vaginalis and the sac were common. A specimen has not yet been found in the corresponding hernial sac of the female, but only about 40 cases of the 700 were in this sex. This point is interesting as accessory adrenal tumors are commoner in the female. I have not yet observed an example of adrenal rest in an adult hernia but the cases operated upon have not been so numerous. The microscopic appearances are well shown in the accompanying photomicrographs which have been kindly prepared for me by Dr. Haswell Wilson, pathologist to the hospital.

The interest in this observation besides the embryological one lies in the support which it gives to the saccular theory of hernia. In an article I published in SURGERY, GYNECOLOGY & OBSTETRICS, January 1910, on the saccular

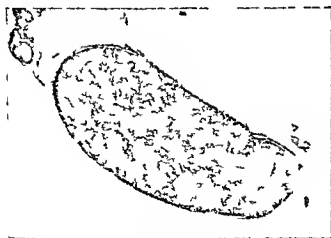


Fig. 1. Photomicrograph (x30) of section of typical nodule embedded in hernial sac.

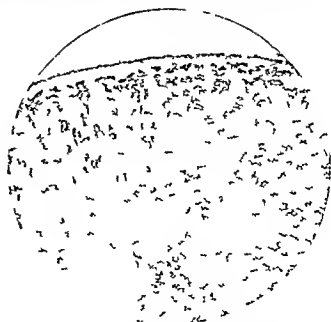


Fig. 2. Photomicrograph (x80) of section of typical nodule.



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d l n d l mb dd d a h l

theory the rare type of encysted hernia was shown to be congenital and if the saccular theory still requires further support it receives it from this fresh observation. Adrenal rests are recognized as being sometimes found lying along the cord or in association with the testicle but their presence attached to a hernial sac claimed to be acquired negatives such a supposition.

The fate of these nodules is uncertain probably they atrophy they do not evidently give rise to tumors later on. The removal of this supplementary adrenal tissue has not been detrimental to the children. Since within this note another instance of an adrenal rest has occurred. This time the little mass was surrounded by fatty masses which had they been larger would have constituted the well known lipomata of the cord the nodule was less closely attached to the sac. The microscopic finding was the same as in the others.

## DIVERTICULA OF THE POSTERIOR URETHRA

B H C BUMPUS M.D. POCHÉ ER. MINNESOTA  
F m th S U l y M Cl

THE repeated finding of diverticula of the posterior urethra during routine cystoscopic examination led to a search through our records and the literature for similar cases. As was expected few were found.

The literature as reviewed by Ehrlich revealed but 70 cases of urethral diverticula up to 1908. Watts reported one case and reviewed the literature in 1906 and Engländer added two cases in 1917. In our cases the diverticula were all confined to the posterior urethra their clinical histories vary considerably from those reported in the literature.

Watts besides his complete and thorough review of the literature gave an excellent classification of urethral diverticula which we have adopted.

A Congenital diverticula

### B Acquired diverticula

- 1 From dilatation of urethra due to
  - a Calculus
  - b Stricture
- 2 With perforation of urethra resulting from
  - a Injuries to the urethra
  - b Rupture of abscesses into the urethra
  - c Rupture of cysts into the urethra

A differentiation is also made between true and false diverticula. The former is a dilatation of the normal urethra with a mucous membrane lining identical with that part of the urethra from which it arises. The latter is the result of urethral rupture and therefore has a lining of epithelium or fibrous tissue according to the extent of repair that has occurred. Of the true diverticula the congenital offers the most perfect type. It occurs in the anterior urethra and is

probably the result of a failure of the urethral floor to close during fetal life a condition similar to that of hypospadias or as Watts suggests a condition due to congenital stricture or phimosis

Diverticula of the posterior urethra are probably always of the acquired type and usually traumatic in origin. Surgical procedures about the penneum either for the drainage of the seminal vesicles as in Case 1 or for the removal of the bladder or prostatic stones as in Case 4 are probably the most frequent factor in their formation. Frequently the falling aside some hard object with resulting rupture of the urethra or the formation of a hematoma with secondary rupture into the urethra results in their formation. Strictures are also an etiologic factor both because of their tendency to cause dilatation posteriorly and because of the inaccurate passage of sounds in an attempt to dilate with resulting false passage and urethral rupture. Abscess formations in the neighborhood of the posterior urethra or in the seminal vesicles as in Case 3 with secondary rupture and drainage into the urethra are frequently the origin of diverticula.

In cases in the literature a tumor at some point along the urethra is an almost constant finding and the history of being able by digital pressure to express varying amounts of urine from such a mass is considered very suggestive. In our series but one patient (Case 4) gave such a history. This fact seems most pertinent as our illustrations show to what size such diverticula may develop and yet give no physical signs they even burrow under the bladder until they nearly equal it in capacity (Fig 5). Lane reported several cases similar in character found at necropsy and Isaacs reported one that caused death by rupturing into the peritoneal cavity with resulting peritonitis.

Diverticula of the posterior urethra give a series of symptoms which are the result of a chronic inflammatory process going on in close proximity to the sphincter musculature and involving the urethra itself. (1) Dribbling or complete incontinence depending on how near the diverticulum is to the external



FIG. 1. Lead catheter coiled in a diverticulum of the posterior urethra (Case 1)

sphincter and to the extent it has become involved in the inflammatory tissue produced by it (2) dysuria resulting from the passage of urine through a constantly inflamed and irritated posterior urethra producing pain and scalding often accompanied by tenesmus and (3) the presence in the perineum of a pocket filled with infected residual urine causing a constant feeling of discomfort often described as resembling a ball of fire which compels frequent urination in an effort to relieve.

That such diverticula may be overlooked is easily understood if it is realized that the condition is often associated with a normal bladder as it was in three of our cases. Unless one uses an endoscope or a direct cystoscope the floor of the posterior urethra may be overlooked. In Case 1 a cystoscopic examination had been made previous to our examination and the patient was told that conditions were normal.

The etiologic factors in three of our four cases were the result of former operations for the drainage of infected tissue in the other two the result of spontaneous drainage of abscesses into the urethra.

CASE 1 (263163) C. L. M. a single man aged 33 was admitted to the clinic March 12 1919. The patient had had gonorrhea four years before and operations as follows: Drainage of seminal vesicles in 1911 followed by repeated injections of the epididymis on both sides with silver salts.

Fig 3 I d th t s c d t d rt l m fill l

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Fig 100

appendectomy June 10 5 and cystostomy Dec m  
ber 9 8. He complained of dribbling and frequen  
cy. Followed the incision and infection he had tri  
anous form of treatment without result and finally  
had had both seminal vesicles treated with com  
plete relief for three months. After the old symptom  
of urinary frequency and penile pain returned  
treated with extreme nervousness loss of weight  
akn's and noise. His appendix was removed  
at this time and six months later cystostomy. The  
bladder drainage as done without thought of it.

This case is an illustration of closed bilateral thickening  
of the prostates and of the left vesicle. An  
analysis of a recent four hour specimen of urine  
showed 0.0 cubic centimeters with specific gravity  
of 1.03. Acid reaction a trace of albumin  
no sugar an occasional red blood cell and large  
amounts of pus. The phenolphthalein test  
of the kidneys gave a reaction of 60 per cent return  
of the dye in two hours. X-rays of the kidneys  
ureters and bladder were negative. The systolic  
blood pressure 130 the diastolic 90.

Cystoscopic examination revealed a normal  
bladder with clear urine coming from each meatus  
and a normal internal urethral sphincter. In the  
posterior urethra just anterior to the cumm  
trum was an opening into a diverticulum filled  
with phosphatic deposit and pus. A lead catheter  
was coiled in the diverticulum (Fig 3).

Operation was advised as we believed that a  
diverticulum in this position by keeping up a con  
stant source of inflammation about the internal  
sphincter and in the posterior urethra could ac  
count for the dribbling and dysuria and that it  
probably was a large factor in the causation of the  
patient's extreme nervousness.

CASE (193464) W. C. S. a married man aged  
36 registered at the clinic May 8 1917. The  
patient had had a light nervous infection of two  
week duration in 1901 appendectomy in 1900  
and an exploration and drainage of the penum  
followed a rifle bullet wound in 1903. From the  
site of this wound a 2 caliber bullet entered  
the penum and lodged behind the symphysis  
(Fig 2) he had had constant pain in the bladder  
the urethra discharged pus. The pain was exag  
gerated when the bladder was full or the abdomen  
was distended it radiated to the glans penis during  
micturition.

Physical examination was negative except for a  
right inguinal hernia a penile scar and a ure  
thral discharge. The analysis of a recent four  
hour specimen showed 0.0 cubic centimeter a  
specific gravity of 0.0 alkaline reaction a slight  
trace of albumin no sugar and a large amount of  
pus. The blood examination showed a negative  
Wassermann hemoglobin of 10 per cent 4,500,000  
red blood cells and 6,800 white blood cells. Repeat  
ed smears of the urethral discharge showed many  
pus cells but no characteristic gram negative  
diphtheria. X-rays of the kidneys ureters and  
bladder were negative except for the presence of  
the rifle bullet and its fragment (Fig. 2).

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der with clear urine coming from both meatus  
The internal urethral sphincter was normal. In  
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trum as an opening into a diverticulum. Into  
this a lead catheter was inserted (Fig 3). The  
diverticulum was then filled with the same  
4 shot as the tent and position of the diverticulum  
in relation to the bullet fragments. The diverticu

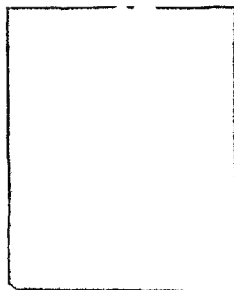


Fig 5

Fig 5 Cystogram of bladder and of diverticulum of the posterior urethra (Case 3)

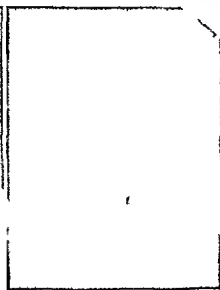


Fig 6

Fig 6 Lead catheters coiled in diverticula of the posterior urethra (Case 4)



Fig 7

Fig 7 Diverticula of posterior urethra filled with thorium and the bladder filled with silver iodide showing latent bladder and the relative position of the two diverticula

lum was evidently the result of the bullet wound or of the subsequent drainage of the wound and accounts fully for the painful urination and constant urethral discharge

CASE 3 (21435) I B a married man aged 40 came for examination November 21 1917. The patient's history was negative except for an axillary abscess seven years before. Following an attack of inflammatory rheumatism four years before he commenced to have attacks of dysuria which became more and more frequent and were accompanied by frequency and nocturia all of which grew progressively worse until four months before when he was obliged to wear a urinal. The passage of urine was attended with great pain and scalding. During the past four years he had lost much weight and strength he complained of frequent night sweats and chills.

Physical examination revealed many signs of old tuberculous processes in the lungs and a bar of hard firm inflammatory tissue about four inches up in the rectum. A twenty-four hour specimen of urine 1,350 cubic centimeters gave a specific gravity of 1000 alkaline reaction a trace of albumin no sugar many red blood cells and much pus stained specimens of which failed to show tubercle bacilli. Four guinea pigs were injected with specimens of bladder urine obtained on different days and at necropsy one pig showed miliary tuberculosis foci throughout the peritoneum. The phenol ulphonaphthalein test of kidney functions showed a 33 per cent return of the dye in two hours. X-rays of the kidneys ureters and bladder were negative that of the chest showed calcified pleurisy at left base and a healed focus of tuberculosis at right apex.

Cystoscopic examination showed a chronic inflammatory tuberculous type of bladder with many areas of granulation tissue and cicatricial changes involving the internal sphincter which was completely relaxed. On the floor of the posterior urethra just anterior to the verumontanum was an opening into a diverticulum about 3 centimeters in diameter. This together with silver iodide and a cystogram (Fig 5) shows the diverticulum to be nearly equal in size to the bladder. The diverticulum probably was primarily an abscess in one or both vesicles which ultimately ruptured into the urethra. While the abscess cannot alone be considered the cause for all the present urinary symptoms since the bladder is so extensively involved it may well be the etiologic origin of them.

CASE 4 (20573) R L C a married man aged 40 came to the clinic April 1 1919. The patient had had an operation for multiple bladder and prostatic stones in 1910. He complained of incontinence and perineal pain and of always having had great difficulty in emptying his bladder which seemed to lack musculature. Often he was obliged to double himself up and exert pressure super pubically in order completely to empty the bladder. In 1907 marked bladder irritability commenced accompanied by dysuria and frequency. In 1910 the perineal operation was performed and following this sphincter control was lost and he was obliged to wear a urinal. He has also had some difficulty in the control of gas and feces if the bowels are too full.

Physical examination showed a well developed man of 166 pounds having a systolic blood pressure of 160 and a diastolic of 100. A transverse perineal



## TUBERCULOSIS OF THE ANUS

By CHARLES J. DPUECK, M.D. Chicago

Assistant Professor of Rectal Diseases, Postgraduate Medical School

**T**UBERCULOSIS is one of the terrible and destructive infections of the lower intestinal tract which may appear in a variety of clinical pictures. It may be primary or secondary. Primary tuberculosis of the anus or rectum appearing as the only evidence of phthisis in the individual is very rare. Secondary tuberculosis on the contrary is quite frequently seen as a result of the swallowing of sputum by the patient who is suffering with pulmonary tuberculosis. In health the hydrochloric acid of the stomach will destroy the tubercle bacilli but in the debilitated individuals where the gastric secretions are of weak quality the bacilli pass into the intestine unimpaired. Also the mucus of the sputum protects the bacilli in their passage through the acid gastric juice.

*Anal tuberculosis* Tuberculosis of the skin about the anus may appear as military ulcerative lupoid or verrucous lesions. Military tuberculosis about the anus is very rare and occurs as a complication of tuberculosis of other organs. It develops as millet seed sized nodules grouped in crescents or circles which begin in the hair follicles sebaceous or sudoriferous glands of the skin. Later as the infiltrations enlarge necrosis of the superimposed skin occurs and small cup shaped ulcers with ragged borders appear. There is a slight discharge of seropus but no bleeding. These ulcers usually continue as small single necroses but sometimes they coalesce into extensive wounds. Their blood supply is poor and they do not bleed on handling.

*Ulcerated anal tuberculosis* Tuberculous ulcers of the anus begin insidiously. Some times there is a history of a known injury although often this injury is so slight as to be forgotten until brought to mind by the examiner's questions. For example a diarrhoea horseback or bicycle riding or a thrombotic hemorrhoid has been followed by an area of induration at the anal margin which persists for a long time and finally ulcerates. The ne-

crosis may begin on the external skin or within the anal canal. As the ulcer spreads it usually involves both the perianal skin and the anal mucous membrane. Tuberculous ulceration in the anal mucosa does not confine itself to a sulcus as does a fissure but widens out in all directions. The borders of these ulcers are clear cut undermined and pale with a ring of raised induration all about the ulcer. The base of the ulcer is irregular and gray in color and does not bleed easily. On the surface of the ulcer may be seen small yellow tubercles. There is not much pain with the passage of feces or on the manipulation of examination. This is quite in contrast to the sensitiveness of the irritable ulcer. This freedom from pain distinguishes the tuberculous ulcer from fissure, chancre, mucous patch and rodent ulcer. The discharge is scant and thin and but rarely is tinged with blood.

The clinical course of these ulcers varies greatly. Some extend slowly while others spread rapidly and destroy all structures. Unlike syphilitic ulcerations there is no healing at one spot while ulceration progresses at another but rather the tubercular ulcer spreads continuously in all directions. The ulcer is not usually fatal but it contributes to the general breakdown of the patient.

CASE 1 is a typical history. Male age 43 occupation retail grocer clerk, nativity Irish American. In June 1915 he showed pulmonary tuberculosis and has been under institutional care almost ever since. In August 1916 he suffered with hemorrhoid which prolapsed for several days and were finally replaced by a physician. The patient applied an ice bag to the anus almost continuously thereafter for the next four weeks and about that time noticed a marginal abscess. The abscess was opened but did not heal and has continuously discharged since that time a thin watery or sometimes a yellowish excretion. There is no pain at stool or on walking and but little pain after the manipulations of dressing the wound. This patient has active pulmonary tuberculosis and is losing weight.

On inspection we found an ulcer at the mucocutaneous junction in the posterior quadrant of the anus and to the right of the median line. It was





Fig. C

one half in the depth on the left side  
up into the ulcer and out at the top. It is  
very irregular in outline. It is a very  
glittering and digressive ulcer about the  
granulation (Fig. C)

Case 1. A patient with a tuberculous  
ulcer of the rectum. The ulcer is  
also a typical (Fig. C)

In both of these cases the possibility of tuberculo-  
sis is forced upon us by evidence of the disease elsewhere.

**Lupus of the anus.** Lupus was long considered a syphilitic manifestation but is now known to be tuberculous. It is slow in spreading but in its aggravated type is terribly destructive of tissue. The disease begins at the mucocutaneous junction at the anus or vulva as a small soft reddish brown nodule in the corium (apple jelly ulcer) which later breaks down into a small clear cut ulcer irregular in outline and having an indurated base. A characteristic pus discharge can always be found in some of the affected area. Cicatrization appears in some ulcers at times but it soon breaks down and the ulceration extends wider. A dense fibrous infiltration beneath the ulcer seems to prevent its deepening but does not interfere with lateral spreading which may be caused by enlarging of the individual ulcer or by the confluence of small ulcers into large one.

**Differential diagnosis.** Lupus is to be differentiated from cancer and syphilis. Cancer rarely occurs in early life and if it does it runs a very rapid course. On the contrary lupus frequently appears in children and persists to

adult life. The base of the cancer ulcer is pearly white indurated uneven and glazed and its edges are everted. Lupus ulcer are usually multiple have soft insensitive bases and edges covered with granulations. The secretions of a cancer are scanty and fetid while the discharge of a lupus sore is profuse and odorless.

**Pathology of tuberculous ulcers.** At the terminal bowel tuberculosis produces the usual inflammatory changes together with intense and rapidly developed proliferation. When the bacilli and their toxins are present in sufficient numbers the whole area dies and is coagulated. The first evidence of the tubercle bacilli in the tissues is the development of translucent gray nodules. The single tubercle is so small as to be hardly visible to the human eye. These tubercles have a tendency to group together and coalesce into rounded or mulberry shaped masses about the size of millet seed (miliary tubercles) or they may be as large as walnuts. These masses at first are firm in substance but later undergo caseating necrosis in which calcium salts may be deposited and the whole converted into a mortar like substance. More often however the mass often probably because of secondary infection and an abscess results. Healing may take place even now by incision of the necrotic material and the formation of a dense surrounding capsule of tuberculous scar tissue. If healing fails the abscess ruptures a yellow opaque substance is discharged and there is left an ulcer with ragged nodular thickened and undermined edges. Its base is generally covered with yellow necrotic material which when removed exposes the tuberculous granulation tissue which lines the ulcer. This ulcer may extend to the deeper coats or even perforate the bowel. At the anus the ulcer may extend to the subcutaneous connective tissues.

On the skin about the anus and the mucous membrane within the rectum there may develop tuberculous granulation tissue. This mass is highly vascular and is produced as a reaction to the tubercle bacillus. Although it is well supplied with blood vessels this tissue has a strong tendency to undergo caseation necrosis. This crusting mass may be heaped up above the level of the surrounding tissue.

About this mass a dense fibrous layer may form which ultimately may heal over completely as a hard contracting scar provided new granulations do not form.

Tubercle bacilli may be transported through the body (1) mechanically along with air food or secretions and in the digestive tract by the action of gravity or muscular activity (2) by extension from neighboring growths (3) by lymphatic and blood streams.

By these avenues great numbers of bacilli and their toxins may be suddenly thrown into the body causing an acute tuberculous septicæmia or as otherwise called acute miliary tuberculosis. From intestinal tuberculosis the mesenteric lymph glands or even the ductus thoracicus may be involved.

#### *Treatment of tuberculosis at the anus*

Prophylaxis is all important. The tuberculous patient should be thoroughly and repeatedly impressed that it is through swallowing the sputum that the bowels become infected. Various procedures have been carried out hoping to produce immunity but the use of tuberculin and also the transplanting of tuberculous lymph nodes into normal animals have both been unsatisfactory. When infection and ulceration have occurred medication by mouth is not beneficial. These patients have poor digestion and unpalatable drugs by mouth further upset the appetite.

#### *Treatment of anal ulcerative tuberculosis*

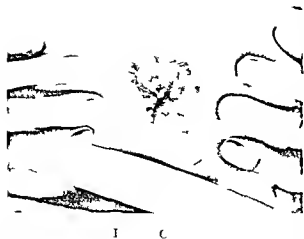
If the patient's initial tubercular lesion is of moderate extent or is not active the ulcer may be thoroughly curetted with the Paquelin cautery removing all of the necrotic tissues of the edges and base of the ulcer. I prefer the cautery to the knife as by that means the lymphatics are sealed beyond dissemination is prevented. Thus we improve the patient's resistance. Following the cauterization the anus should be exposed to the sunlight and air for several hours each day. The patient can soon be taught how to spread the nates and expose the anus. If any part of the body which is normally covered shall be thus suddenly exposed directly to the



FIG. 2 CASE

sun's action blistering and painful tanning occurs. Therefore during the first few days the nates should be covered with a cotton sheet. Later this is replaced with three layers of cheese cloth, one layer of which is removed after a few days, the second a few days later, but at least one layer of cheese cloth should always cover the parts as a screen against the action of the sun. It is remarkable how quickly relief and healing take place. When a patient is weak and we think not equal to the cauterization even under local anæsthetic surprising results may be obtained by exposure to the sun.

*Treatment of lupus at the anus* Most satisfactory results are obtained by phototherapy (Finsen light) concentrating the light rays on a small area of skin for about an hour. The next day a small blister appears and this is dressed with a soothing ointment. After all irritation has subsided another exposure is given. The treatment is very tedious. The roentgen ray also produces good results and is sometimes more convenient. Its action is pushed to the extent of producing a burn which is then protected with a soothing dressing. The scars following either of these plans of treatment are much less objectionable than those of any other plan of procedure.



o half an h l i v o n h i n g l a n t  
up to th u an l out th kin It h  
v r regular n l o l l i n l t e a l r y l  
g l t n i n g n t l e d n g a n l w a t h u t a s p o i n t  
o f g r a u l t ( l i i )

C a f e z a l h c i v p u l m o v t u l r u l o s  
H i s h l o i v e r y m l t o C a n t h u l c e r  
l o v r y t y p e l ( f i g . )

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cephalus or to a malpresentation. When the fused lower limb presented as it sometimes did the diagnosis of presentation was thrown into doubt.

*Clinical History.* None of the recorded infants survived its birth for more than a few minutes or at most hours. This is not surprising when we consider the abnormal conditions discovered by dissection. But Cichorius has recorded an interesting case of Siren formation—the child living for a week after birth—in Leipzig clinic.

The morbid anatomy is a somewhat complicated subject.

1 *External appearances.* The fused lower limb is usually directly continuous (as in this case) with the lower (subumbilical) part of the trunk and it is flattened anteriorly and curved posteriorly. It is capable of being folded upward upon the anterior surface of the trunk. In one of the recorded cases the fused foot lay over the right shoulder and near the right ear. The lower part of the abdomen shows a tendency to narrow as it approaches the lower limb and this tendency, along with the form of the fused limb, gives to the foetus its cuspidate appearance. It is ending in a point. There is no trace of external genitalia. Posteriorly there is a linear depression with radiating furrows which possibly indicates a rudimentary anal aperture. The body of this monster above the umbilicus is normal.

2 *The conditions discovered by dissection are interesting.* The sacral and coccygeal vertebrae are less in number and the sacrum as a whole is tilted upward; the ilia are spread out laterally so that the anterior superior spines are directed to the sides and downward; their fossae are flattened. The tuberosities of the ischia are turned inward and their ascending rami are joined in a horizontal plane with disappearance of the obturator foramina. In front of the ischia there is a projecting crest formed by the horizontal rami of the pubic bones. The ischial and pubic bones unite to form a mass which blocks the pelvis and shows a wide

cotylod cavity for the reception of the large head of the fused femora. It is on account of these conditions that Taruffi places symphus among the pelvic monstrosities (Lecanoterati). A careful study of the lower limb after dissection shows the following.

The femora are completely fused with a single large head fitting into a single cotylod cavity with two condyles articulating with a single tibia and no fibula.

The evidence of two bones in the thigh is well shown by the two nutrient foramina (seen in the roentgenogram) which are present on the post aspect of the femora which are rotated in such a manner as to bring the external surfaces internal and posterior surfaces anterior and the knee flexes anteriorly. There is no foot at all.

The pelvic organs are absent; that is the kidneys, ureters, bladder and the genital organs, but the right suprarenal capsule is present. The rectum and the vermiform appendix are also absent; the descending colon ending blindly. The urachus is wanting. The umbilical cord has only one artery and one vein.

Putting all these facts together we may come to the conclusion that in symphus the derivatives of the allantois (urachus and part of bladder) and its vessels (umbilical arteries and veins) are usually absent and that the vessels of the cord are omphalo-mesenteric or vitelline in origin.

Symphodia is relatively somewhat rare; only 116 instances were gathered together up to 1897. This variety—symphus apus—is rarer still.

The teratogenesis is a subject which has been fruitful in ingenious explanations and yet cannot be regarded as in any degree settled. There is no explanation offered for the extraordinary rarity, the almost complete absence of any cases of symphodia in the lower animals.

#### REFERENCES

- 1 BALLANTYNE Antenatal Pathology and Hygiene the Embryo
- 2 BIENSTADT and BLACHER Malformations of the Foetus

## SYMPUS APUS

By S. CHELIVIAH M.D. C.M. (Madras) Co. OMBO C. ALON  
A. I. P. th. l. g. C. I. H. p. al. C. l. m. b.

**T**HIS still born monster was delivered at the Lying in home at 8.10 p.m. on January 25, 1919 and sent on to the Pathological Museum of the Ceylon Medical College for preservation. Sympus may be defined as a monster in which the lower limbs are fused together to a greater or less degree and with an imperfect development of them and of the neighboring pelvic organs and pelvis.

Synonyms: sirenomelus and symelus. The terms mermaid fetus and fetus with a tailed appendage have also been employed. None of these terms is quite so good as sympus which indicates the fusion of the lower limbs as the essential feature of the anomaly. Symelus for instance simply means a monster in which the limbs upper or lower are fused. To adopt the terms sirenomelus or sirenomiform fetus is

to liken the monstrosity to a fabulous creature (the Siren) and is scarcely scientific. Sympus is therefore the most appropriate name.

**Classification.** (1) According to Geoffroy Saint-Hilaire this monster belongs to the class single monsters to the order autostote to the family teratomelians and to the genus Symelians. (2) According to Forster this belongs to the class sympus apus in which the fused lower limbs end simply in a tapenn point (as in this case) or in a stump like that seen after an amputation.

**Obstetric History.** In this case pregnancy seemed to have terminated prematurely; the fetal movements were sluggish and toward the end of pregnancy not felt at all. Liquor amni was small in quantity. The labors are in these cases often easily delayed when it does occur is commonly due to an associated malformation for instance hydro-



The photograph of the

cephalus or to a malpresentation. When the fused lower limb presented as it sometimes did the diagnosis of presentation was thrown into doubt.

*Clinical History.* None of the recorded infants survived its birth for more than a few minutes or at most hours. This is not surprising when we consider the abnormal conditions discovered by dissection. But Cichorius has recorded an interesting case of Siren formation—the child living for a week after birth—in Leipzig clinic.

The morbid anatomy is a somewhat complicated subject.

1 *External appearances.* The fused lower limb is usually directly continuous (as in this case) with the lower (subumbilical) part of the trunk and it is flattened anteriorly and curved posteriorly. It is capable of being folded upward upon the anterior surface of the trunk. In one of the recorded cases the fused foot lay over the right shoulder and near the right ear. The lower part of the abdomen shows a tendency to narrow as it approaches the lower limb and this tendency along with the form of the fused limb gives to the foetus its cuspidate appearance, i.e. ending in a point. There is no trace of external genitalia. Posteriorly there is a linear depression with radiating furrows which possibly indicates a rudimentary anal aperture. The body of this monster above the umbilicus is normal.

2 *The conditions discovered by dissection are interesting.* The sacral and coccygeal vertebrae are less in number and the sacrum as a whole is tilted upward the ilia are spread out laterally so that the anterior superior spines are directed to the sides and downward their fossae are flattened. The tuberosities of the ischium are turned inward and their ascending rami are joined in a horizontal plane with disappearance of the obturator foramina. In front of the ischium there is a projecting crest formed by the horizontal rami of the pubic bones. The ischium and pubic bones unite to form a mass which blocks the pelvis and shows a wide

cotylod cavity for the reception of the large head of the fused femora. It is on account of these conditions that Taruffi places symphus among the pelvic monstrosities (*Lecino terata*). A careful study of the lower limb after dissection shows the following.

The femora are completely fused with a single large head fitting into a single cotylod cavity with two condyles articulating with a single tibia and no fibula.

The evidence of two bones in the thigh is well shown by the two nutrient foramina (seen in the roentgenogram) which are present on the post aspect of the femora which are rotated in such a manner as to bring the external surfaces internal and posterior surfaces anterior and the knee flexes anteriorly. There is no foot at all.

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BIRNBAUM and BLACKER Malformations of the Foetus

## EARLY SURGICAL AND ORTHOPEDIC TREATMENT OF HEMIPLEGIA<sup>1</sup>

By JOSEPH BYRNE M.D. MRCS ALFRED S. TAYLOR M.D. FACS D  
SAMUEL W. BOORSTEIN M.D. NEW YORK

### NEUROLOGICAL STANDPOINT

By JOSEPH B. R. E.

THE prevention of deformity and disability in hemiplegics by early surgical and orthopedic measures though not new to the profession has not received the attention it deserves. The possibilities of group treatment along the lines set forth in the following pages are especially written in the case of disability from war injuries and it is mainly with the hope of stimulating interest in this direction that we have undertaken to publish the results obtained during the past few years in the First Surgical Division of Fordham Hospital.

Hemiplegia is the immediate result of suspension of function in the upper motor system of neurons. The usual cause is some serious interference with the circulation (hemorrhage embolism thrombosis) the mechanism consisting of

1. *Direct lesion*—severance or changes in the paths consequent on impaired blood flow (contusion laceration necrosis etc.)

2. *Indirect lesion*—compression of the paths as the result of hemorrhage edema etc.

3. A combination of (1) and (2)

Although not commonly found as a sequence of skull injuries hemiplegia is occasionally met with as the result of compression from extradural hemorrhage of traumatic origin from neoplasms and from cystic formations that sometimes follow intradural hemorrhage. Compare the large hygromata described by Virchow which develop in conjunction with the repeated extravasations in *pachymeningitis hemorrhagica interna*.

### ANATOMICAL AND PHYSIOLOGICAL REMARKS

The mechanisms involved in the production and symptomatology of hemiplegia call for a few words as to the anatomy and physiology of the parts involved. The dura mater over the convexity of the brain consists of (1) an inner more or less dense fibroelastic layer containing many connective tissue cells and lined on its inner surface by a single layer of flat cells (2) an outer layer like the inner layer but more richly supplied with blood vessels and nerves. Between the inner and the outer layers lie the large venous sinuses. The dura acts as the inner perosteum for membranous cranial bones. On the convexity of the skull it is attached to the bones and can be readily detached without rupture into the subdural space. It is because of these facts that fractures of the vault are usually simple whereas fractures of the base are invariably compound. The separability of the dura from the bone at the convexity plays an important role in the mechanism of extradural hemorrhage from rupture of the middle meningeal artery or of one of its branches. Because of their wide spreading terminal ramification in the dura the combined tensile strength of the smaller arteries greatly exceeds that of the parent stems which are more or less firmly anchored at or near the origin of the middle meningeal from the internal carotid just outside the foramen spinosum. When therefore the shape of the cranium is temporarily altered by a blow or fall e.g. on the side of the head the distance between the origin of the artery and the site of its terminal ramifications is suddenly increased the artery itself or one of its primary divisions is put on the stretch and ruptures at the point of least resistance. Coincident with this there occurs a displacement partial or complete of the loosely attached outer layer of the dura on the convexity or side of the skull.

F m th r t s i D f f th m H p t l N w y  
Th p w l Th f m d b Alf d s f l ( h b p  
J ph B Th rth d f sam h d by  
l by S m l W Boo P pe re d bef h X Y k New  
l Soc y d N l Sec f A d my f M d m  
M h s d e or be l Cou y M d l Soc M h

With the rupture of the artery hemorrhage sets in which tends to continue not so much from failure of coagulation as from the difference in pressure conditions obtaining within the artery (normal blood pressure) and without it in the extradural space (where the pressure is practically nil). In this latter after primary displacement of the dura on the bone or even without such displacement the adhesive force binding the dura to the bone more nearly approaches the expanding force of the venous than that of the arterial pressure. The result is a steady *flow* of blood into the extradural space in spite of a normal tendency of the blood to coagulate.

Another important anatomical point is the type of blood supply found in the cortex and within the brain. On the cortex owing to the free arterial anastomosis there is a rich collateral blood supply through which moderate disturbances in the circulation at any point may be readily compensated. On the other hand the arteries entering the base of the brain from the circle of Willis through the substantia perforata anterior and posterior to supply the basal ganglia, centrum ovale and internal capsule are all end arteries so that lesions (necrosis softening etc.) in these regions resulting from circulatory failure or obstruction are likely to be permanent as there is no provision for compensation through collateral blood supply. This fact taken in conjunction with the condensation of nerve paths that occurs in the internal capsule and in the ventrolateral aspect of the thalamus gives serious significance to the relatively small lesions occurring in the vicinity of these organs.

#### PATHOLOGICAL REMARKS

Pressure upon the cortex from hemorrhage extradural or intradural sufficient to cause hemiplegia usually terminates in death if unrelieved. The mechanism here is obstruction of the capillary circulation in the medulla with consequent strangulation of the vasomotor and respiratory centers.

*Remote causes.* Small intracerebral lesions in the vicinity of the internal capsule may cause hemiplegia by increasing the intracranial pressure to a degree that may even

threaten the medullary centers. In any lesion following trauma the edema of repair may add its quota to the general burden that may already hamper the medullary centers. In severe cases of contusion this may be the deciding factor of life or death. In such lesions also secondary hemorrhage may occur as the result of rupture of damaged vessels (traumatic apoplexy). This also may be a vital factor in determining the issue.

The main problem in the cases under consideration from the point of view of early surgical interference is the relief of intracranial pressure that menaces life or hampers restoration of function. For some time past one of us (Byrne) has been studying clinically and experimentally the respiration as an index of increased intracranial pressure. From studies it has been concluded that the apnoeic period in Cheyne Stokes respiration is the result not of the fall in arterial pressure (capillary anæmia) as Cushing asserts but of a deficiency of carbon dioxide (over aeration). In our experiments the sequence of events most usually observed in the kymographic tracings was fall in blood pressure enhanced respiratory movements rise in blood pressure apnoea (diminished carbon dioxide) fall in blood pressure and so on. The whole respiratory mechanism serves ordinarily to a large extent as an auxiliary of the circulation aiding by its thoracic pumping action blood movements from abdomen to chest and from chest to medulla. But what we would particularly call attention to here as an index of disturbed medullary circulation is that modification of the respiratory movements which consists mainly in a *relatively prolonged and more or less accentuated expiratory phase*. To make accurate observation of this we have been in the habit of using a stop watch and timing the different phases of respiration as follows: (1) from the beginning of inspiration to the beginning of expiration ( ) from the beginning of expiration to the beginning of inspiration (3) period of rest. Where the medullary centers are in distress expiration which often appears as biphasic i.e. divided into two distinct acts is prolonged at the expense chiefly of the period of rest which may be completely



absent but also in part at the expense of inspiration. This type of breathing is different from the normal. Wherever it is present it gives cause for concern and it is always a welcome sign in any kind of illness in which it is encountered when there is a tendency toward a return to the normal.

This altered ratio of inspiration and expiration may be accompanied by mild phases of periodic expulsive or modified Cheyne-Stokes respiration. It may be stated here that in animal work where the respiration ceased it was always the expiratory mechanism that gave out first. This seems relevant in view of the fact that overaction of this very mechanism is the chief feature of the clinical and experimental phenomenon to which we call particular attention.

#### INDICATIONS FOR OPERATION

In one of the cases such as those found in intracranial hemorrhage, traumatic or spontaneous, the greatest care should be taken to study the effect of the increased intracranial pressure and the capacity of the brain and cord to make compensatory adjustments. The pulse rate, blood pressure and eye ground should be systematically studied from hour to hour or even more frequently to determine how the medullary centers are withstanding the strain. Above all the behavior of the respiratory center should be carefully watched as this is the most sensitive of the medullary mechanisms to alterations in intracranial pressure.

From the moment the medullary mechanisms give unmistakable indications of being unable to cope with increased intracranial pressure, surgical intervention is to be regarded as a conservative measure.

The foregoing remarks apply to lesions which in addition to causing hemiplegia also threaten life. But operative interference may be indicated in lesions which because of marked focal pressure may cause permanent paralysis or deformity. Such lesions are mainly of the intracerebral type, those most suitable for operation occurring in the vicinity of the internal capsule where a very small lesion so readily causes permanent hemiplegia.

Three types of vascular lesion of traumatic or spontaneous origin demand consideration of the surgeon: (1) extradural (2) intradural (3) intracerebral.

The *extradural* lesion is often limited practically to hemorrhage from the middle meningeal artery or one of its branches. In its typical course the clinical picture of the condition is very characteristic with its primary period of unconsciousness due to compression. These phenomena are accompanied by signs of progressively increasing intracranial pressure which when maximally exerted on the motor area may cause in sequence: (1) primary focal anemia which finds expression in focal irritative signs such as twitching etc. (2) general anemia showing itself in general compression which manifests itself as generally inhibitory phenomenon e.g. hemiplegia, general paralysis etc.

In some cases extradural hemorrhage may be associated with cerebral contusion direct or from contrecoup and the clinical picture will be a composite of the two conditions. In these cases the intracranial phenomena should be studied along the lines laid down for *compression*. The pulse rate, blood pressure, respiration and eye ground should be studied from hour to hour and the presence or absence of irritative or paralytic signs noted. A leucocyte and differential blood count are also of value in diagnosing contusion and the advent of infection etc. The spinal fluid often yields important information but if unpleasant after effects and serious accidents are to be avoided the utmost care has to be used in making the lumbar puncture and the fluid withdrawn intermittently, slowly and in small quantities through a small needle, the patient's head being lowered and the hips raised (where there is reason to fear sudden or undue pressure on the medulla from alteration of hydrostatic conditions obtaining within the cranio-pinal cavity).

In *intradural* lesions of traumatic origin the hemorrhage is usually venous and tends to become checked automatically without seriously threatening the medullary or other mechanisms. Such conditions however are usually associated with contusions of greater

or less extent and the resulting *edema of repair* as well as the incidence of secondary arterial hemorrhage (traumatic apoplexy) are matters of concern and may call for operative interference (decompression) which in many instances the operator will find it to his advantage to make upon the sound side of the head as a precaution against further hemorrhage. Intradural hemorrhage does not usually cause hemiplegia or focal pressure signs although under certain circumstances (*edema traumatic apoplexy* etc.) it may.

Though in general early operative interference is contra indicated in intradural hemorrhage nevertheless resulting intracranial conditions such as general pressure for pressure the possibility of cystic formations and growth etc. may outweigh all other considerations. Spontaneous intradural hemorrhage is usually of arterial origin and where it is large enough to cause hemiplegia it usually destroys life if the intracranial pressure be not relieved by surgical measures in time to prevent medullary strangulation.

There are many conditions e.g. paresis, pychmeningitis hemorrhagica interna etc. in which numerous repeated small intradural hemorrhages occur presumably from miliar aneurisms with immediate effects that are usually but slight and transient. In any of these conditions menacing symptoms may appear at any time and operative measures may be indicated.

It is worth while recollecting that intracerebral hemorrhage of traumatic origin may result from injury to the vessels with subsequent delayed hemorrhage (traumatic apoplexy) or from early decompression operations for intradural hemorrhage accompanied by confusion or from gunshot wounds or the injudicious use of sharp pointed exploring needles. It may occur anywhere in the brain but is usually found in or near the cortex and generally associated with subdural extravasation.

Intracerebral hemorrhage of spontaneous origin results from arterial degeneration (arteriosclerosis, endarteritis, tumors, gliosarcomata etc.). By far the great majority of spontaneous hemorrhages result from

arterial disease of the intracerebral type and occur as Charcot pointed out in the vicinity of the internal capsule as the result of rupture of the so called lenticulostriate artery (artery of cerebral hemorrhage). Small hemorrhages in this vicinity may cause widespread sensory and motor disturbances due in part to direct lesion of the nerve paths (laceration, softening etc.) and in part to focal pressure from arterial hemorrhage followed at first by clot formation and later by cysts which may grow. These possibilities suggest at once surgical intervention as a means of preventing deformity and disability. Removal of the small clot and of the collection of serum surrounding it is often readily effected by the mere passage of a moderate sized Cushing exploring needle through the brain substance. This relieves focal pressure and prevents degeneration of tissue as well as cystic formation both of which contribute so largely to the extent and permanency of disability.

We would particularly emphasize at this point the need of making careful studies of the newly born and of all infants and young children in whom there is reason to suspect intracranial complications from trauma, infectious disease or other cause. In any of these conditions valid indications for operative interference may be found and it is at or near the onset of the trouble that the best results are to be obtained if we seek to prevent cerebral maldevelopment and the train of mental and physical disorders that is so commonly associated with it.

An early operation even if its purpose be merely to effect decompression may so relieve focal compression as to restore the circulation of the blood and cerebrospinal fluid in important structures and thereby promote nutrition and growth in tissue that would otherwise degenerate or remain stunted. Although operative interference has been recommended and may be of benefit in intracerebral thrombosis and embolism it is chiefly in conditions of hemorrhage that its best indication is found.

#### DIFFERENTIAL DIAGNOSIS

A few points of differentiation between these different conditions are *apropos*

*a Hemorrhage* Age over 45 onset sudden during effort arteriosclerosis present high blood pressure

*b Thrombosis* Age under 45 onset during rest or sleep etc. endarteritis present Heart enlarged to the left normal or lowered blood pressure luetic myocarditis onset is not so sudden and distinct as in hemorrhage

*c Embolism* Age under 45 onset sudden on exertion or after taking circulatory stimulants History of infection of tonsils etc. rheumatic endocarditis neoplasm trauma pulmonary and other types of embolism heart enlarged to right myocarditis decompensation auricular fibrillation paralysis may have intermission

### SURGICAL STANDING

BY ALBERT S. LARK

The paper by Dr. Byrne has brought out very clearly the indications for the operation and also how the cases have been studied. When the patients are presented the method used in each case will be discussed so as to bring out clearly all the facts about the surgical and orthopedic measures employed. The main object in presenting the case is to stimulate interest in the early treatment of hemiplegia.

We do not claim that the work is original. A case was reported in 1911 by a railroad surgeon in Pittsburgh who operated on a railroad conductor. Some months after the operation the patient showed no evidence of ever having had trouble with the central nervous system. Hudson reported eight or ten cases. The method used is the ordinary subtemporal decompression with evacuation of the clot. A piece of bone two by three inches is removed the dura is opened and if the clot is in the brain a grooved director or a Cunningham exploring needle is slipped in at the site of the clot and the latter extrudes of itself. It is not necessary to go into details about the steps of the operations as they are well known. The principal point is this:

If one can get good results from patients with hemiplegia of long standing by a subtemporal decompression as will be shown in some of our cases this operation seems desirable in recent cases of hemiplegia. It will save them from a great deal of pressure and destruction of brain tissue also from the usual spasticity of the muscles with resulting contractures.

It seems logical that decompression with evacuation of the clot should give all the recovery that can be gotten in hemiplegia and ten times as rapidly as by waiting for the clot to be absorbed. One may argue that it is not advisable to add the danger of operation to the pathological condition of the patient. This however is an erroneous idea. The operation is comparatively a slight one, no anesthesia needed, the unconscious patient standing, the operation well. There is no shock and very little bleeding. The whole thing is of little menace to the patient. It has been done several times by me without anesthetic. We wish to emphasize that there is no hook attached to the operation and the operation is not dangerous. If a clot the size of an English walnut had formed in the brain (as in Case 4 of our series) manifestly the best thing to do would be to remove the clot and nature would have a better chance to bring about restoration. In a fair number of cases there will be much greater improvement than by expectant treatment and it is worth while to give the patient the benefit of the doubt.

Even in cases of thrombosis this operation may be tried as the area of necrosis in the region of the obstructed vessel will be benefited by any procedure which diminishes or alters focal pressure conditions and therefore favors the establishment of collateral capillary or perivascular circulation.

One must always consider the possibility of cystic formation (as demonstrated in Case 4) and the pressure which might be generated by the activity of secreting cells throwing their output into a tightly sealed cavity.

# ORTHOPEDIC TREATMENTS PREVENTION AND CORRECTION OF DEFORMITIES

By SAMUEL W. BOORSTEIN

Everyone knows that after an attack of apoplexy the victim becomes an invalid and a deformed cripple. Either he is not able to walk at all and is compelled to remain in bed during the rest of his life or if he recovers and is able to move about his gait becomes abnormal and his paralyzed limbs often become deformed and distorted. Even the layman will call such a patient a real cripple. Still how often is the attempt made to prevent and correct these deformities by the early application of orthopedic principles as in the case of other diseases where deformities result as exemplified in anterior poliomyelitis and spastic paraplegia.

The attending physician usually watches the case for three to four months and is satisfied with the improvement attained at that time. If the patient is then able to get around the physician considers it a good result. If contractures develop he considers that as an inevitable evil and accepts it as a matter of course.

It is for the purpose of interesting the profession in the early and proper orthopedic treatments that this part of the paper is written.

Let us at first survey briefly the deformities that occur in hemiplegia.

The distal segments of the limbs, the feet and the hands are affected more often than those near the trunk. At the onset of the attack there is sometimes a temporary initial rigidity of the muscles of the paralyzed side or an early rigidity may develop in one or two days. At about the second week there is always a late rigidity. This which at first is slight gradually increases and finally contractures affect the paralyzed limbs. The shoulder is adducted. The forearm is bent at a right or an acute angle, the hand usually pronated and slightly flexed, the proximal phalanges slightly flexed, the middle and terminal phalanges more so. The fingers are tightly shut into the palm of the hand. If an endeavor is made to straighten the forearm the muscle tension has to be overcome. This may

be wholly or only to a certain extent successful but the forearm immediately returns to its former posture. The flexed fingers can be extended only if the wrist is put at first in extreme flexion. In the lower extremity the hip is adducted and internally rotated. Contracture of the knee is not very rare. The foot presents marked deformities. The tendo achillis is contracted and the foot is in the posture of talipes equinovarus, i.e., heel up, toes down and turned inward. The rule seems to be that the larger flexor groups of the extremities and the adductor muscles are selected. It is probably the disparity in strength between the flexors and extensors that determines the contractural postures as a result of the hypertonic condition of the muscles.

In discussing the treatments of the paralyzed limbs the text books on neurology do not sufficiently emphasize the necessity of preventing contractures.<sup>1</sup> Some do mention that splints should be applied but the importance of this is neither impressed upon the reader nor are the details of application given. Others (Foster and Oppenheim<sup>13</sup>) are on the contrary satisfied that the position of the paralyzed limbs should frequently be altered to avoid contractures. Some add massage and passive movements to prevent the evil consequences of deformities. Tilney<sup>17</sup> emphasizes more in detail the use of the splints. Still how many physicians have ever put a splint on a patient's hand or foot at the onset of a stroke of paralysis? On the contrary they discourage the use of splints or plaster.

In the neurological service at Montefiore Home and Hospital where we always have about 60 to 70 patients with hemiplegia I have not met even one patient who gave a history of having been watched by his attending physician immediately after the apoplectic attack for contractures. It is there that my interest was first aroused in these cases. Dr. Elliott and myself had abundant opportunity to verify the observations that Wink had made on monkeys and we found to be true

<sup>1</sup> Th. W. L. H. J. A. C. H. (5) Ch. h. d. l. t. (6) W. H. J. A. C. H. (5) Ch. h. d. l. t. (7) W. H. J. A. C. H. (5) Ch. h. d. l. t. (8) W. H. J. A. C. H. (5) Ch. h. d. l. t. (9) W. H. J. A. C. H. (5) Ch. h. d. l. t. (10) W. H. J. A. C. H. (5) Ch. h. d. l. t. (11) W. H. J. A. C. H. (5) Ch. h. d. l. t. (12) W. H. J. A. C. H. (5) Ch. h. d. l. t. (13) W. H. J. A. C. H. (5) Ch. h. d. l. t. (14) W. H. J. A. C. H. (5) Ch. h. d. l. t. (15) W. H. J. A. C. H. (5) Ch. h. d. l. t. (16) W. H. J. A. C. H. (5) Ch. h. d. l. t. (17) W. H. J. A. C. H. (5) Ch. h. d. l. t.

in human beings that in the early stages the contractures can be remedied and likewise in old and neglected hemiplegics great improvement can be obtained. We have treated there a practically bedridden invalid with marked deformities i.e. flexion of the thigh on the abdomen and of the leg on the thigh with the foot in marked posture of talipes equinovarus of 1 year's standing and succeeded in making him walk. He is able now to walk for a considerable length of time. I have reported the case in detail together with Dr Elliott in the *Journal of the American Medical Association* 1916 (8). The method was then tried on a few early hemiplegics and we have likewise succeeded in overcoming their contractures.

After Dr Taylor had operated on the first patient in this series of hemiplegias and had seen the beneficial result it was decided by the three of us to make use of the orthopedic principles that were employed by Dr Elliott and myself at the Montefiore Home and Hospital. These treatments were therefore instituted at the same time that the operation on the skull was done or usually a few days after the operation. We found that it is much better to apply splints immediately.

**Technique** The lower limb was put in a plaster cast extending from the toes to the perineum. The foot was at right angle to the leg and the knee extended. Though Tilney (17) claims that full extension of the leg on the thigh not only causes an unnatural position of the body but by producing an unusual strain on the muscles will prove fatiguing it seems to us that the discomfort of the patient should be sacrificed for the prevention of the knee contraction. Hossa of Berlin, Lazarus and others have distinctly recommended the use of splints in hemiplegic paralysis of the leg with elastic bands to replace the deficient flexion of the knee and to insure dorsal flexion of the foot.

If one is really looking for the comfort of the patient he may order a brace with a drop ring to permit bending of the knee when required and to allow its extension on walking. As a point of interest I may mention the case of a patient with multiple neuritis who had been receiving in Montefiore Home and

Hospital massage exercises and electrical treatments for three years but had not been able to stand on his feet. On application of plaster casts to his knees he felt more secure in his attempts at walking and within 2 to 4 weeks the splints were discarded and the patient walked freely. We can therefore conclude that plaster casts for the knee will give the patient a certain security and thus encourage early walking. To prevent adduction of the hip we imply put sand bags or pillows between the knees.

For the upper extremity the shoulder is kept abducted to a right angle by placing sand bags near the chest or one may put the shoulder on a wire splint or a plaster spica or a Jones abduction splint which is so easy to apply. In choosing the best position for the elbow one has to remember that the tendency is for flexion at a right angle or an acute angle and it would therefore be natural to place it in a straight line (full extension) but this would interfere with the use of the limb as people cannot have much use of a straight arm. It seems logical to place it in a position midway between flexion and extension e.g. at an angle of 135 degrees. This is simply an arbitrary figure with us. The forearm is put in full supination.

The hand deformity is the hardest to handle and really requires more guarding than the other parts of the limbs. The recovery is also less certain. It is therefore of paramount importance to have the hand slightly hyperextended at the wrist as to an angle of 165 degrees while the fingers are straight but in order to prevent hyperextension of the metacarpophalangeal joints these may be slightly flexed. This position can be retained in a plaster splint in a Jones cock up splint or Taylor splint (Fig. 4). All these contrivances or splints not only prevent contractures but also help a great deal to relieve the painful cramps so commonly found in these conditions.

These temporary splints are left on without disturbance until one is ready to begin with massage. If plaster has been used it is then cut into halves and removed for massage and exercises. If the patient can afford it braces can then be applied so that it will be easier to

remove them. If braces have been used from the beginning of course no change is necessary.

The question of prevention of contractures arises only in persistent hemiplegias. There are rare cases where the resultant paralysis is flaccid i.e. in extensive foci which involve both motor and sensory cortical areas. The muscles retain their posture but undergo moderate atrophy. These cases of course need no splints but one is not certain whether it will be a flaccid or spastic paralysis hence prevention is important.

#### MASSAGE AND EXERCISES

Massage and exercises form a very important part in the treatment of the affected limbs and it is essential to obtain more definite ideas as to the time, duration, frequency and forms.

*When to begin massage.* No specified time can be given. Bucholz ( ) advises massage as early as the second day with the idea of lowering the tension of the blood vessels but it requires the utmost care. Oppenheim (13) on the other hand advises massage two or three weeks after the apoplectic stroke. The general opinion is to begin about two or three weeks after the attack. This was our custom where we had a chance to treat the patients immediately after the apoplectic seizure.

*Forms of massage to be used.* Oden (12) in an excellent article on Systematic Therapeutic Exercises of Paralysis in Hemiplegia where careful observations and experiments are reported shows that general massage as used by the masseuse does not bring the desired effect and on the contrary is distinctly harmful. He emphasizes the fact that certain muscles are flaccid and others spastic for instance the upper extremity shows spastic paralysis of the flexors and flaccid of the extensors.

The form of massage to be used for spastic muscles must be different from that used for flaccid. (For contracted or spastic—effleurage should be used while for the relaxed muscles—petrissage and tapotement<sup>1</sup>).

Thus when there is a contraction the muscles should be treated by effleurage of a very light form and the corresponding antagonists should be exercised by petrissage and tapotement. The nerves to the relaxed muscles also should be stimulated by petrissage but it must be kept in mind that too strong stimulation may be of no value or it may even be harmful (in this respect there being a condition like that of Pflueger's law) since strong stimuli may not only decrease but also temporarily abolish nerve irritability. (Oden 12).

In short attention should be directed (1) to increase the tone and the strength of those muscles that are flaccid and atrophied and (2) to reduce the contracture state in the muscles that are tightly contracted (tonus is shortening). It is not the quantity of the massage which is of benefit it is the quality.

*Exercises.* It is advisable to lay special emphasis on the following points (1) That it is not wise to prescribe exercises in a general way and leave the parents or the masseuse to attend to the details (2) that the physician must study the case thoroughly to know to what extent the nerves and muscles are affected (3) that he must give the exact details of the exercises. Indicate therefore the muscles to be exercised the character of the exercises the number of times that the particular movements are to be performed at each session as well as the number of sessions each day.

*When to begin the exercises.* Opinions vary on this point ranging from one to six weeks. H. Oppenheim (3) in his excellent book on nervous diseases discourages early movements stating that there can be no question that these attempts at movement encourage the development of contractures. Hence even if the leg has regained a certain degree of mobility the patient should still spend a greater portion of the day in bed. In reality no specified time can be given each case being considered individually in relation to its sensitiveness the amount and character of the contractures. During the first week, light passive exercises for the fingers hands toes and feet are used. They must be performed slowly and easily. In the second week the

forearm and leg likewise may receive passive motion

In our cases we began massage and exercises in the third week after the operation as we were anxious to see the relaxation of the muscles and the improvements from the operation. To go into details about the exercise is not within the scope of this paper. We made use of symmetrical exercises in which the good limb performs at the same time the same motions that are expected from the affected limb (taking advantage of synkinesia in moving one limb the other may move). In the beginning the exercise were given from 10 to 20 minutes and then for 1 minute twice a day. By consulting Irenkel's book on reflexes one arrives at an understanding of how to teach the patients the proper way of walking sitting down and getting up. The importance of exercise in the elderly patient may be measured by its beneficial result: (1) It avoids the effect of general idleness; (2) it improves the paralyzed muscles; (3) it prevents arthritis of the joint so common in these cases; (4) it lowers blood pressure; (5) it stimulates endocrine secretion.

*Electric treatment.* As in all forms of nervous disease electricity has its advocates. Some advise galvanic others faradic while some give tribute to sinusoidal current. We do not care it present to discuss the merits of each of these forms of electricity. The physician can use the form he has most faith in or the form most available. It is to be understood that electricity indiscriminately used is capable of increasing the hypertonia which it is intended to combat.

Thus far I have emphasized the need of prevention of contractures. It will be worth while to say a few words about curing the contracture if present at the time of consulting the physician. The details of these methods can be found in any orthopedic book.

For the elbow joint gradual stretching by applying a plaster cast and wedging it or reapplying new cast every two or three weeks as the palsy is relaxed. The same principle holds true for the knee joint. For the wrist and fingers one can make use of the

Jones method of treatment of Volkmann's contractures (10, 11 and 15). As mentioned before the fingers can be straightened only when the wrist is flexed. Apply therefore a brace (Jones' cock up splint or brace advocated by Taylor Fig. 4) or a plaster of Paris splint with the wrist completely flexed and the fingers straight.

*Method of application of Jones' splint.* (1) An assistant passively flexes the wrist to allow the fingers to extend and each finger is separately trapped to a little gutter shaped plaster so that it cannot curl up. (2) A day or two later or in milder cases at the same sitting the metacarpophalangeal joint is increased and the palm and splinted finger are bandaged to a flat metal splint. The whole hand and the fingers are now rigidly fixed with the wrist flexed. (3) The wrist is now from day to day extended a little and fixed. This is continued until the wrist is hyperextended. The hyperextension of the wrist and finger is maintained for a long time. Keep the plaster for a long time until the chance of recurrence disappears.

For the lower extremity it is advisable to overcome at first the resistant contraction of the knee (the cutting of the tendo achillis for the drop foot before the knee is straight would induce a calcareous deformity of the foot). One may apply a plaster splint and extend the knee gradually. An open tenotomy of the hamstrings may be indicated. Precaution must be used in straightening a joint that was in contracted flexion for a long time not to rupture the shortened vessel. One must also remember that arteriosclerosis usually the underlying cause of apoplexy and sudden stretching may cause rupture of the artery. Even in a case of 2 years duration we were able to correct a markedly contracted knee by gradual stretching.

At the time of straightening the knee the foot is put at right angles with the leg. Later on the tendo achillis may be cut and the foot put up in overcorrection. The various positions also corrected by tenotomy of the plantar fascia and forcible correction. When the plaster is removed a brace can easily be applied. Sometime tendon transplantation is advisable.

## CONCLUSION AND SUMMARY

Our studies lead us to conclude that

1 Early operation within two to four weeks or even after a much longer period may be indicated in hemiplegia—

a Where the intracranial pressure threatens medullary strangulation no matter what the site or nature of the lesion

b In extradural hemorrhage with or without intradural hemorrhage or cerebral contusion where cerebral compression threatens life or permanent disability

c In intradural hemorrhage of traumatic or spontaneous origin where cerebral compression threatens life or permanent disability

d In intracerebral hemorrhage where focal compression threatens life or permanent disability

A subtemporal decompression and evacuation of the clot is a simple procedure and should be used in every case of fresh hemiplegia where the above mentioned indications are present

2 If the patient be unconscious an anesthetic need not be used as the shock of the operation is small

3 Even in old cases of hemiplegia decompression is of benefit

4 Decompression should be used even in cases due to embolism or thrombosis

5 The deformities and contractures of hemiplegia can be prevented

6 Patients with hemiplegia should be put in the same category as anterior poliomyelitis and receive proper orthopedic treatments from the beginning

7 Inter splints should be applied immediately to prevent contractures

8 Massage and exercises are indicated and should be used intelligently

9 Proper use of the limbs should be shown to the patients and encouraged

10 In old and neglected cases deformities should be corrected and recurrences prevented

## REPORT OF CASES

CASE 1 Intradural hemorrhage right hemiplegia and aphasia Operation recovery with full function H. R. C. age 39 on night of June 1, 1916 fell from a street car striking on left parietal region

of head Primary unconsciousness was followed by lucidity Right hemiplegia with motor aphasia and a trace of left external strabismus were present June 11 the patient was in coma blood pressure 150-90 pulse 44 respiration 28 average ratio of inspiration to expiration in seconds 1:1.5 with no pause between expiratory phase enhanced 1:1 slightly forced and puffing and prolonged at expense of period of rest

Physical examination Motor Right arm and leg motionless eyeballs moved independently and showed simultaneous divergence movements of the left eye restricted compared with right Sensory Responds to prick pinching and squeezing all over trunk limbs and face Reflexes Iliogastric abdominal and cremasteric absent on right knee jerks equally exaggerated on both sides ankle clonus present on both sides but more marked on right Oppenheim and Gordon showed extensor response on both sides more marked on right Pupils Almost pin point left larger fundus oculi outlines of left disc slightly blurred vessels fuller than on right

Diagnosis 1 Intradural hemorrhage operation performed by A. S. Taylor 1 hour after injury No anesthetic During the trephining the patient breathed forcibly and rapidly making an inspiration and more especially on expiration a noise resembling steam rushing from a pipe This ceased the moment the disc of bone was removed as the clot began to extrude but showed signs of returning when twinges of pain began to be felt When the opening in the skull had been enlarged a large clot was removed the patient having sunk into a natural sleep pulse 12 respiration 3 with normal ratio of inspiration expiration and pause

Recovery was slow but complete with a gradual return of function At first there was disorientation and sensory as well as motor aphasia Gradually the patient learned to appreciate his surroundings and to speak simple sentences to understand spoken and written language No orthopedic treatments were used in this case

On September 12 (three and a half months later) all he had gained in the way of speech etc was suddenly lost through psychic shock when the patient was told that his child had an attack of infantile paralysis an epidemic which was then prevalent For days he could not understand written or spoken language and could not speak During this time he was confined to bed On May 30, 1917 without apparent cause he had twelve convulsions lasting about 10 minute which began on his right side and extended to the whole body consciousness not being lost (wife's report)

On February 16, 1918 (one and a half years later) his mental and physical condition was excellent There was a slight constriction of the visual fields on the right side The patient was engaged at his regular occupation as buyer for an export house A later report informs us that in the fall of 1918 he had convulsions again



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**Electrical treatment.** As in all forms of nervous diseases electricity has its advocates. Some advise galvanic others faradic while some pay tribute to sinusoidal current. We do not care at present to discuss the merits of each of these forms of electricity. The physician can use the form he has most faith in or the form most available. It is to be understood that electricity indiscriminately used is capable of increasing the hypertonus which it is intended to combat.

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skull had been opened. Resuscitation by Laborde and modified Schaefer methods of artificial respiration operation continued. Extradural clot found. Symptoms improved temporarily but patient died about midnight.

**CASE 3** Intradural hemorrhage with hemiparesis and lucid interval suggesting extradural hemorrhage operation recovery.

**A** G male. On January 14, 1918 while coasting fell over embankment striking on head. Primary unconsciousness. Projectile vomiting blood in vomitus. The patient was conscious on admission. Pulse 72, respiration 32 with slightly phasic variations. The patient lies on his back with legs drawn up and somewhat stiffened. *Motor* Flattened facial expression on left. Has little or no power in left arm. Seems to move both feet equally well. *Sensors* Sensibility for sharpness (pin prick) impaired on left (face, arm, hand and trunk) no apparent impairment in legs or feet. *Reflexes* Epigastric and abdominal absent on both sides. Cremasteric present and equal. Left knee jerk exaggerated. Plantar gave extensor response in both feet more marked on left. Eyes persistently turned to right with slow jerking movement to left which however never carried the eyes beyond the primary position. Tendency of trunk to rotation along axis to right so that the right side was under most in bed. The pupils exhibited remarkable changes. At first they were dilated and equal. Right was later larger than left (6 and 3 millimeters) still later when the patient went into coma both pupils became small but the right was larger (4 and 2 millimeters) even now there were slight hippus movements in the right and marked primary dilatation to light in both eyes with prompt recoil into constriction. At this point the pupils became smaller and the primary dilatation to light gradually disappeared. At times even now the pupils showed rhythmic alternations in dilatation and constriction the patient remaining in coma. The pupillary measurements were right 4 millimeters, left 3.5 millimeters. Extreme difficulty was encountered in attempting to study the fundi. All that could be definitely ascertained was that there was vascular fullness. At this time the pulse was 60 with the respiration showing slight phasic variations. There was no marked rise of blood pressure. Spinal fluid contained blood. The patient showed some signs of improvement which however were temporary.

Operation by Dr. A. H. Harrigan. Osteoplastic flap on right side. A few small extradural and one large intradural clot were found. The patient was in a precarious condition from 24 to 48 hours after the operation but made a good and complete recovery. No orthopedic method was used.

**CASE 4** Spontaneous intradural hemorrhage (thrombosis?) with cystic formation causing left hemiplegia. Operation 20 months after onset. Marked relaxation of spasticity after operation. Orthopedic treatments were of great help.



FIG. 4. Case 4. Shows the braces applied to the paralyzed limbs and the good position obtained. Note Jones brace for the hand.

**A** OS female age 48. Apoplectic attack during pneumonia in June 1916 causing left hemiplegia. Examination on February 13, 1918 showed *Motor* Marked spasticity in left arm and leg with contractures (fingers closed tightly in the palm) foot in the position of talipes equinus. *Sensors* Impairment for superficial (light touch, sharpness etc.) as well as for deep pressure touch compass points consecutively applied etc. *Critical stimuli* No appreciable impairment for affective stimuli (pressure pain etc.) was observed in left calf. The defect in sensibility was more marked in the hand than in the foot.

Operation by Dr. Taylor February 10, 1918. A large cyst containing fluid under pressure was found at the site indicated (fig. 1). Running up from the cyst which was at the site of the fronto-parietal operculum was an area of softened brain tissue fluctuating and easily compressible. This was probably the lesion which gave origin to this cyst. It was originally intracerebral, the extravasated blood finally finding its way to the surface of the brain. Immediately after the operation the left hand and foot were found relaxed. This history

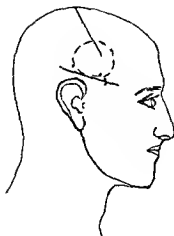
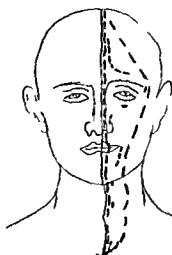


Fig 4



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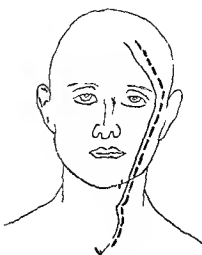


Fig 6

Fig 4 Sl l t f th t Sld  
l f u f R l d nd S l D u d l  
t h h ch d l f l n f l g a Sh f d C t  
ft d d t l h d  
Fig 5 C W k f m th ut i d th  
m l p t f th f th l p se t h l n f  
f l s r d b l t y f l l D t l d h  
p k f l m t t g m l O i l f  
d l p t l f f th m t l t i th  
4 g am l l f d l p t h f

eight d x t l m t r Sld l t h f h a r  
l f v t c l h b l t f r t h l g t h t g  
b t t t h m d l l  
Fig 6 C l l f d l 55 C b g t d s  
m f i th t f th t m l u b g p o o l y p p  
l d f l l d l tube bega t b e f l t  
l t c u y f l l f d l t b a p p r a d d  
l d t t m O th m d f th l f t h l f f  
th l d y l l t y t f f p e f i l n d l p  
l t l m d f f t f f t f t m b g  
l s e l t h l t f f d p f t t m l

CASE Extradural hemorrage of left side of  
b in ith s g s of o t u s n a l l f t h e m p l e  
H m p l e g n c s i g n a n d e p u e s f h n m n a f  
i r r i t a t a n d h l t i n g i n t d c o l s r e f t  
s i d e h e e r t h e x t e l n a r k t o l e c a n d  
o c u l a r p h n n p o i n t e d t o a l f t s i d l l e s t n  
b o t h d t p h i d l l a j s e r u c i t a t i s u l  
s e q u e n t i a t h

L H m a l 15 y a f a g t h n f r m f e t b y  
c o a s t i n g l d a b u t a m D e m b e r 1 0 7  
H a s u n c t u a t t e t l a t r n s u s A t  
5 p m h r g e d o c u s n s p a l a d  
c h l l y a d s t i l i n l k p u l 1/4 l l d p r s e  
8 8 z e s p a t 30 p h n t r e f l f l o r e  
p o n o n b o t h l t h n o a l a t o  
r e i n l f t p u p l s m l l e r t h a n r i g h t l t h r e f t d  
t o l i g h t S l c o n j u n c t a l e h y m s l e f t v e  
a n t e n t u n o f l f t i d e o f f a c a d h a d D e  
m b e r 8 a n t h e i t t t s n h v t u p o r  
i t h m a k d e s t l n e s a d i n d n v t r l l t  
r i g h t o f a c p u l 60 r p r t i n 28 i t h n m a l  
r a t i n d h y i h m b l o l p r e s s r e 4 64 I m  
p a r l m t o p r n l f t i d e K l l x s f p g u s t r i c  
a n d a b d o m i n l a b e n t o n b t h s d e r m s t n e  
e a s i l y f a t i g u d c e p l l n l e f t k n e a n d a n k l e  
j e r k s e a g g e t d n l e f t a n k l e c l n u p e e n t o n  
l e f t p l n i n d O p j e n h i m g a v e e x t e n o r e p n s e  
o n r i g h t a n d l e f t s i d e t h c o r d o n t h l a t t e g n g  
u n a d l i t n f r o m b o t h s d e s a r e a d i l y l c i t l e r s e d  
e x t e n s o r s p o e i n t h g r e a t t o e T h s p o s s b l y

m a n t c o m m e n g p a r l y o f S h e i g t o n s p e  
p i n l e n t r y t h c v r s i n t o t h e s u p l i f i o n  
t y p o f e s s e F u n t D s c o u l n e s l i g h t l y o b c u r e d  
t h s e l f u l l a n l t o r t u o u b t h s g b e n g m o r e  
m a r k d n l e f t l u p i l L e f t 5 m m l m t e r r i g h t  
4 m m l m t s T h e e f f e r e s a n d l o s s o f m t o r  
p e r p i n t e d r i g h t s i d e l e o n h e a s t h e  
o u l a r p h e n o m e n a a d t h e t e r n a l v i d e n c s o f  
i n j u r y p o i n t e d t o a l e f t s i d e l e n (l o s s l y t h s  
a s a c s e n h i l t h e p y r a m i d l t a c t s l d n o t  
l e u s a t e)

A b o u t n o o n o n D e m b e r s p a n s a p p a r e d  
n t h l f t a r m t d i n g t t h e h o l e o f t h l e f t  
s i d n d t h e n o r t h h o l e l o d y C o n u l o n  
c a m e a f t e r c n v l s o t h e h l b d y l a t e r o g o i n g  
i n t o a s t a t e o f t n i g d i t y f m t m e t t i m e t h  
t h e c e p t o n f t h l f t a r m h h n w r m a i n e d  
f l c i d A t 6 p m t h e p u l e v a s 3 r e p a t i o n  
36 t h e p i a t o y p h a l g c e n t u a t e d a n d  
p r o l g e d n o p a u s e a f t r x p r t n p h a s c p r o d  
s u g g e s t i n g t h e C h e y n e S t h s t y p F u n d i D i s c  
o u l t n e m o e b l r e d t h a n a t a m v e s e l f l l e r  
a d n n t o t u o A l l p h e o m e a m o m a r k d  
n l e f t e v e l u p l B o t h m o d e r a t l y d i l e d l f t  
l a g e r n o r e c t i o n t o l i g h t e t h e r n p l m i n a y  
d l t a t o n o i n c o n s t i c t

O p e r a t i o n p e r f o r m e d b y D r L o u s M a r t t  
6 p m o n D e m b e r 8 0 7 r i g h t d e o f s k l l  
t e p h n d n o c d e n o l e n l e f t s i d t h e n t r e  
p h n e d b u t t r t s t o p p e d b e t h n g b e f o e t h e

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**CASE 4.** Spontaneous intradural hemorrhage (thrombosis?) with cystic formation causing left hemiplegia. Operation 6 months after onset. Marked relaxation of spasticity after operation. Orthopedic treatments were of great help.



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1 k s c c L I h th t t t h k k  
N t t l k l d t t t h l All t t f  
C o t k J o s

for a y e k h th nature left mt b g n  
to r a p e r l l t e p l i n e t h n p p l e d t y  
D B o r t e t k f t h e h l o l f o t t h  
p o t n d e r l T h i m i g h t h b a p p l l  
t h l e t t e u l t m e l t i v f t r t h p u  
l u t e d t i e e n g h t t u  
v o u l d e u r T h n t n t c l l  
o p e r t i v t m e n t f l m p l g a l t t l l u t u  
t h e c u r l y p t p e u t c r i o g e d i c m s u a n d  
s h t h e i m p r o v e m e n t o l t n e d f r o m t h e d e  
c o m p e s s i o n e n a f t e s c a l g d e l a y

Treatments l g n t n d a y s a f t e t h e o p a t o n  
T h e p l a t c a t e r e l f t o n f o r t o w k t h e n  
a b r c s u l l g 4 A t p r e s e t 6 m o t h  
a f t e r t h e o p t o n t h e p a t i e n t c a n a l k m u h b e t t e r  
a n d h a s f a r s e f t h l m b

CASE 5 Spontaneous intracerebral haemorrhage  
in the vicinity of the internal capsule and external  
lateral aspect of the thalamus causing hemiplegia  
and the thalamus and markedly heightened  
arterial and intracranial pressure in a location

All th p ope d f b s e h d p t f l  
p l n b l t t d e s e s a



l c c p t t l p t t l g h  
p t g t S l t t t f l t t A h l  
l c e o A t h b l t t t  
t h l t l m b t g d j t

t h a t e r s c l o s s a n l l e p h t s p e a  
t o n c l o t a n d e m e v u t l m j n t  
B M c L g s n p p l t i c t k e l y n  
M a c h j C E x m n t i f u k s a f t o n t  
h o d l e f t c c d l m p l i a t h s v i d g  
u g g t g l t f t h n t o l t r a l p o t f t h e  
t h a l u s L u t l r n c r t n f a f f e c t i v e  
t u m l t n t h t i m e

l v m t A p l j 6 l d o o r  
p a t 4 l l d p r u s o o b l l W i  
a n i n g u e p m l s l u l d p u t  
t t l l l t l t t i g e l t h b l d a d a t n n  
p t h l l l l a d l t t b i t e a n d l l l l  
l l u n s p t g t o s t e t l l m  
l l m h l l g n l i r t N r l i a l  
c n t o i l l t f t h a l l a f t c d t j  
S i t t S p t u n t t A t u a l  
s b l t r l t t a l f t n l l d h n  
n F n d T l a p l b l l f

w t t t l l l h p l s l i g h t l  
l i g h t a l f o m j v n h l d h l v n  
p t l r l i t h n m u h t p a  
( u h l n c l t e t ) T h g h t p i l s l r g t h n  
t h l t t n l u m t e r B l l p i l a t l t o  
a c c o m m o d t i n b u t a t t m l t l l u m t n  
T h f u n d h e d b l u r r l l t h l f u l l  
a n i t o r t u u K # T h l i t k n j k a j u s t  
b n n g t s r l t i v e h y p r t t v ( O n  
A p r i l 3 t h j e k s h p a c t e m p d t h  
t l r g h t ) l a n t r r e f l e x h t e r  
s p o n o n l i t O n A p l o r g l t b  
t e m p o l d e o m p e s s o n o p e r a t v a p t m d  
b y D T a l r W h e n t h d u r a s o p e d t h e  
b r a n s u b s t a n c e b l e d i n t t h e o p e n s A n d l e  
w a s p a s s e d t o t h e i n f o h o n f t h l a t e a l  
v t r i c l e a n d c l r s l u i d p t e d s e v e a l c h e s t i  
t b e r T h e n e d l e a n t p a s s d r d t h  
o t r a s p e t o f t h e n t e r a l c a p s l e a d o m e d a r k  
c l s a n d y e l l o s m e t r u d l T h e o p e r a t i o n



Fig. 8. Case 6. Ability to flex the elbow.

was performed under local anesthesia which was used only for the incision into the scalp. Practically no pain was experienced except when the periosteum and dura were cut or pinched. Immediately after operation the threshold for effective stimulation in the arm and hand was exactly the same as it had been just before the operation but the pupil had become smaller the right being larger than left (3.3/5 millimeters). A good recovery was made from the operation but the conditions back of the cerebral lesion were not appreciably helped. The blood pressure at times was very high e.g. 100 millimeters mercury diastolic but the brain and optic nerve functions improved in spite of this and the generally poor condition of the patient. A soft swelling as large as a hen's egg soon made its appearance at the site of the operation. This gave the patient no trouble and undoubtedly had much to do with the improvement noted in the patient's vision and mentality.

In the few months that the patient was under observation there was some improvement in the hemiplegia. The thalamic lesion became stationary and gave opportunity for detailed studies which are reported elsewhere. No orthopedic treatments were used on this patient. In July the patient left the hospital and passed out of observation.

**CASE 6.** Intracerebral vascular lesion in vicinity of internal capsule causing left hemiplegia hemianesthesia etc. operation lesion located in region of internal capsule and actually seen by means of the endoscope.

A 17 female age 1 colored born in United States. In July 1916 was hit on the right side of the head by lid of ice box was not rendered unconscious but afterward was subject to throbbing headaches and the hot weather seemed to affect the head



Fig. 9. Case 6. Shows the fair condition of the skin but unable to extend the finger completely.

Fig. 10. Case 6. Anterior surface of the hand showing the absence of atrophy and the contracture. All pictures of Case 6 were taken in June 1918.

On October 6 1916 in the middle of the day there was a sudden onset. The first signs were in the right cheek and hand. A moment later power was lost in the left leg. The patient then became unconscious and remained so for three hours. When the patient first came under observation there was marked spasticity of the left upper and lower extremities.

On February 3 1917 (four months after onset) Dr. Taylor opened the skull. The cortex looked normal but on passing in an exploratory needle a little over 1 centimeter deep marked resistance was felt. On pushing the needle still farther a small amount of fluid came through the needle it was denser than ventricular fluid and slightly yellowish in color. On pushing the needle still further the ventricle was entered and some normal ventricular fluid came out. It seemed possible that in endoscope through which there was illumination might give some information about this deep lesion so one was inserted and some resistance was encountered. When the light was turned on a perfectly white avascular area of tissue was seen. On withdrawing the endoscope the line of demarcation was visible between the avascular tissue and the normal pink brain substance. Evidently this white area represented some form of induration involving the capsule which caused the marked spasticity.

Since operation the patient has done well and has gained a fair amount of function the most noticeable feature being the freedom of movement of the limbs although the finer movements remain markedly impaired. Massage was started three months after the operation. No plaster or brace was used to prevent contractures as we believed like many others that massage was enough to prevent these. One year after operation the hand began to contract and the tendo achillis shortened giving her a ten

as applied to the hand a special strap was applied to the foot. These were left on for a long time for 24 hours a day and I was on only for the night. The spasm was finally overcome and no recurrence occurred. From this time on our support re applied easily.

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 l i m b s   f r e e   b u t   t u n e r   10   e m e n t s   o f   h a n d   m a r k e d l y  
 i m p a i r e d   a t h e t o i d   m o v e m e n t s   o f   l e f t   m a l l e g  
 ( s e e   F i g s   5 t o   o )   S t r y   ( 1 )   S p o n t   n o u n e  
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 c h i g h t   e t c )   i m p a i r e d   ( c )   u p e r t a l   a f f t i e   e n  
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 o e c a t n   R e p r   S u p e r t a l   i m p a i r e d   d e p  
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th the right The pat ent alk s dy cl d  
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[illegible]

CASE 7. Intra r nial lesion (thrombus n icity of internal c pule) c u g right hemiplegia and motor aphasia per t n o evidence f lot o of increased intrac r nial p esur re cr th decided impro em t n spec h and m tor power

B B male ag d 55 had apoplept st k in  
March 19 6 comp rat ely sl ons t cons i us

ness, lost consciousness. When seen he had typical right hemiplegia with motor aphasia. Repeated efforts to determine whether these symptoms were involved were fruitless (probably on account of his mental inattention). No clinical or neurological evidence of local or a general increase of intracranial pressure. The urine showed no apparent pathological change. Five weeks after onset there being no apparent improvement mental or physical it was decided to operate. On April 5, 1906 Dr. Taylor performed left subtemporal decompression without anesthesia. Only a slight murliness of the gray as found chiefly along the blood vessel of the lower cerebellar and posterior cerebral vessels. The brain was carefully explored but no evidence was found of clot or of increased intracerebral tension. There was degeneration of the cortex and of the tip of the temporal lobe and of the lower motor area suggesting the site of infarction. The patient made a good recovery from the operation. His later cases were applied to the partially edematous case a few weeks after the operation. One week later the patient was encouraged to walk. Miss C. as given three weeks after the operation.

On W ch 1916 examination sho ed An  
intell g t well nour hed man ho in spite f the  
manif est abilities of ld hem ploia alked very  
well Speech h d mproved markedly tho gh it was  
still slightly d fect ve at is Eltop ertorelax the  
qual rcep e tensor fem is safe tu worthy of  
n tie This s p bably to be ttrbuted t the  
early orthop d tre tme t and it s th chief  
reason pe haps hy ther ha been uch m rked  
mp v nent n g t The h nd still kept on a  
Jones plint a the s still tendency f r the con  
tractu e to recur S t r l p n e t for lght  
tou h and l ocal tion h pnes te on ght  
in and leg smell and t e p se d but p haps  
slightly mpaied on right fo sw et

Whether operation benefited this patient cannot be answered positively but personally one of us (Byrnes) inclined to think it did. There are other ways in which operative interference may be of benefit in these cases beside the immediate removal of a clot or a collection of serum. Even in cases which present no gross evidence of a general increase of intracranial tension it is possible that a mere decompressive operation may tend to re-establish the circulation of the blood and cerebrospinal fluid in the vicinity of areas subjected to focal circulatory disturbances as the result of thrombus embolus hemorrhage or other intracerebral lesion. The sudden appearance of improvement right after the operation certainly seems more than a mere coincidence.

NOTE—We had a few cases with hemiplegia due to nephritis and to cerebro spinal lues where no decompressive operations were performed only orthopedic treatments being used. They also showed marked improvement in the pover and gait. All contractions were prevented. The improvements however in our opinion are slower than with decompression.

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## RADICAL RESECTION OF THE OESOPHAGUS FOR CARCINOMA

By DR ADRIAN J BENGOLEA BUENOS AIRES ARGENTINE

FOLLOWING the suggestion of Willy Meyer that surgeons doing thoracic surgery report their experiences whether favorable or unfavorable I wish to submit the history of a case which I believe is the first case of resection of the oesophagus in the Argentine literature. With the exception of the case of Torek reported in 1913 our case has survived longer than any other so far reported and our patient was in very serious condition at the time of operation.

We all know that surgery upon the thoracic organs has been the subject of much thought and although progress has been made with regard to surgery upon some of the organs of the thorax surgery of the oesophagus because of its anatomical situation and its characteristics still presents many difficulties in fact for many years the opinion prevailed that the oesophagus was surgically inaccessible. However I believe that surgery of the oesophagus is in full development and that the means of reaching the oesophagus has been definitely established. I believe that the method of administering the anaesthesia has been so perfected that the danger from pneumothorax is nil and I believe that at the present time contrary to what statisti-

cians may think exploratory examinations should be made for it is only in this way that we can discover cases which may lead to failure and acquire a greater knowledge in regard to treating this condition.

The case I am about to report entered the Rivadavia Hospital on the service of Dr A Zabala who very courteously referred the patient to me for operation.

The patient a woman 31 years of age in a very poorly nourished state complained of an oesophageal affection which had been troubling her for 16 months. The lumen of the oesophagus had become so narrow that for 60 days the patient had not been able to take liquids of any kind. Her weight at the

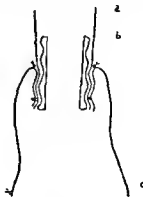


Fig 1 Oesophagogastric tomy. a esophagus b bottom c stomach d diaphragm



dency to dropped foot. A Jones cock up splint as applied to the hind. A special trap was applied to the foot. These were left on for a long time for 24 hours a day and later on only for the night. The spasm was finally overcome and no recurrence occurred. (From this time on no supports were applied early.)

Examination on January, 1918 showed  
 M to Left hemiparesis with slight atrophy of upper and lower limbs gross movements of both limbs free but fine movements of hand markedly impaired athetoid movements of left arm and leg (see lists 5 to 10). Spontaneous movements of hand and legs in pronation and extension when maintained (the distal part of the arm) (1) Active (a) upper extremities sensitive (light to touch and to local anesthetic compass points simultaneously) sharp and the peripheral elements of heat and cold ranging about the neutral point of skin temperature (b) deep cutaneous sensitivity (pressure pain) some elements of vibration gross heat and cold in prolonged mass application perceived with no trace of abnormal overreaction. A few superficial impaired deep exaggerated. Meissner's Excellent. Bright left subject. The reflexes abnormal (The patient had antileptic treatments for months before operation but without apparent benefit. Luetetia of the blood and spinal fluid were at all times negative.)  
 Examination on December 1918 showed some improvement in motor function. Fine movements of the hand still markedly defective cutaneous sensitivity still markedly impaired. Affective sensitivity slightly improved. Dexterity rather deficient. The left arm is small and shorter than the right. The patient talks fairly well and can use a typewriter.

Notes. 1. There is a lesion of the internal capsule presumably hemorrhagic only etiology for ascertained as the injury to the skull. The case is interesting from the physiological standpoint and in the good illustration of the amount of function that is possible after surgical and thopedic treatments. Here the sensibility is manifestly less sensitive than of the left capsule. It illustrates that deficiencies should be perceived as they may occur even on years after the operation.

CASE. Intracranial lesion (thrombus in vicinity of internal capsule) causing right hemiplegia and motor aphasia. Patient on no evidence of clot or of increased intracranial pressure. Complete improvement in speech and motor power.

B. B. male aged 55 had apopleptic stroke in March 1916 comparatively slow onset conscious

ness lost no consciousness. When seen he had typical right hemiplegia with motor aphasia. Repeated efforts to determine whether the sensory mechanism were involved or fruitless (probably on account of his mental and physical condition). No clinical or neurological evidence of lesions or of a general increase of intracranial pressure. The urine showed no apparent pathological changes. Five weeks after onset there being no apparent improvement mental or physical it was decided to operate. On April 5, 1916 Dr. Faylor performed a left subtemporal decompression without anesthesia. Only a slight muddiness of the pia was found chiefly along the blood vessels of the lower precentral and posterior cerebral areas. The brain was carefully explored but no evidence of a focus of clot or of increased intracranial tension. The evidence of degeneration of the subcortical tissues of the tip of temporal sphenoid lobe and of the lateral motor area suggestive of infarction. The patient made a good recovery from the operation. Plaster casts were applied to the paralyzed extremities two weeks after the operation. One week later the patient was encouraged to walk. Massage was given three weeks after the operation.

On March 1916 examination showed. An atellitic ellipsoid mass in the spine of the manfest disabilities of his old hemiplegia walk very well. Speech had improved markedly though it was still slightly defective at times. The posterior lateral quadrate extensor femoris as a feature worthy of notice. This probably to be attributed to the early orthopedic treatment and is the chief reason perhaps why there has been such a marked improvement in gait. The hand is still kept on a Jones splint as there is still a tendency for the contractures to recur. Sensory impairment for light touch and to local anesthetic etc. on right arm and leg smell at distal part preserved but perhaps slightly impaired on right foot.

Whether operation benefited this patient cannot be answered positively but personally one of us (Byrne) is inclined to think it did. There are other ways in which operative interference may be of benefit in these cases besides the immediate removal of a clot or a collection of serum. Even in cases which present no gross evidence of a general increase of intracranial tension it is possible that a mere decompressive operation may tend to reestablish the circulation of the blood and cerebrospinal fluid in the vicinity of areas subjected to focal circulatory disturbances as the result of thrombus embolus hemorrhage or other intracerebral lesion. The sudden appearance of improvement right after the operation certainly seems more than a mere coincidence.

NOTE—We had a few cases with hemiplegia due to nephritis and to cerebrospinal lesions where no decompressive operations were performed only orthopedic treatments being used. They also showed marked improvement in the posture and gait. All contractures were prevented. The improvements however in our opinion are slower than with decompression.

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We all know that surgery upon the thoracic organs has been the subject of much thought and although progress has been made with regard to surgery upon some of the organs of the thorax, surgery of the oesophagus because of its anatomical situation and its characteristics still presents many difficulties. In fact for many years the opinion prevailed that the oesophagus was surgically inaccessible. However, I believe that surgery of the oesophagus is in full development and that the means of reaching the oesophagus has been definitely established. I believe that the method of administering the anesthesia has been so perfected that the danger from pneumothorax is nil and I believe that at the present time contrary to what statisti-

cians may think, exploratory examinations should be made for it is only in this way that we can discover cases which may lead to failure and acquire a greater knowledge in regard to treating this condition.

The case I am about to report entered the Rivadavia Hospital on the service of Dr. A. Zabala, who very courteously referred the patient to me for operation.

The patient, a woman 34 years of age, in a very poorly nourished state, complained of an oesophageal affection which had been troubling her for 16 months. The lumen of the oesophagus had become so narrow that for 20 days the patient had not been able to take liquid of any kind. Her weight at the

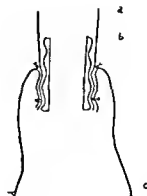
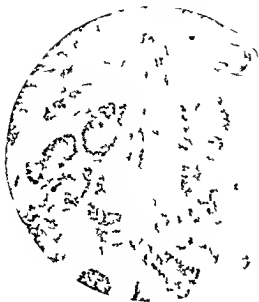


Fig. 1. Oesophagus (a) and (b) showing the location of the oesophagus before and after resection.



Th M p l l d g t m l f m

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I n t h i s v a y i t a p o s s i b l e t o j u d g e s t t h  
a l v i s a b i l i t y o f e s e c t i n t h i m a n d e l l a  
t o t h e p s b i l i t y f r e c o s t r u t i t s l u m n  
c e s o p h a g a t r s t m v T h e p e u m g a t r c n e r e  
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s d e t h u s f e e n g t h c e s o p h a g s t o a g e a t  
e t e n t a s p o s s i b l e T h e c e p h a l c r e c t o n v a s  
b e u n t t h e c a d f l l o n g t h e u s u a l t e c h n q u  
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u r t n l a t h a p l t h a p h g  
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p l l l v p t a g u t u e i l n  
l u a t h t h t d t o t h l g o o  
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s t n t h e l b y c e n t u u h t p l a l  
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g a l t m p T h l p h r a m t i u l l o l  
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D u r n g t h e p r a t n h i l t d t o l a h a l f  
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I n t r t h e a l n u s s i t o n n a s t h e i t h t h e  
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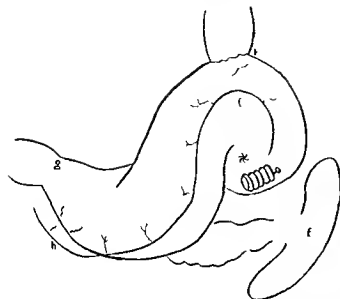


Fig. 3. Autopsy finding showing the stomach displaced posteriorly and the bobbin placed from the anastomosis. a Oesophagus b anastomosis c cardia d bobbin e spleen f pancreas g duodenum h gastro-epiploic artery

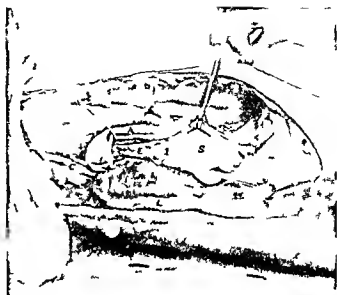


Fig. 4. Autopsy finding showing the chest wall removed and the lungs pulled forward exposing the organ of the mediastinum and the anastomosis. s Stomach l lung a oesophagus a aorta c carotid d diaphragm anastomosis

For three days after operation Murphy procedure was given by the drop method and heart stimulants were also given. Food was given per rectum. Considering the condition of the patient at the time of operation there was no great shock. No dyspnoea the pulse remained between 100 and 120 per minute. There was no vomiting. Food through the mouth was not given until the fourth day at which time the patient took 50 grams of water in small amounts. On the fifth day milk gruel etc. were given. After this the patient was given soups pastes etc. without any inconvenience. On the sixth day the drainage was discontinued. On the seventh day the wound was in good condition and on the tenth day the sutures were taken out.

On the fifteenth day after operation the patient presented a very grave general condition. Heart beats 140 per minute and there was evidence of a very large pleural effusion. The heart apex beat was on the right mammillary line. The drainage wound was reopened and about 3 liter of a sero-purulent fluid were evacuated. New drainage

was established. At the end of 10 days the fluid was of a purulent nature. Nevertheless the patient fed herself and she experienced no difficulty in swallowing.

A few days before death there was extreme oedema of the extremities. The patient was in very bad general condition but her appetite was still good. She died 3 days after operation.

**Autopsy.** The thoracic cavity was opened through the wound of operation. There was found 150 grams of a purulent fluid and some membranous exudate within the pleural cavity. The pleural membrane was thickened throughout and an inflammatory exudate was present. The lung was very much retracted shrunken and was fixed anteriorly to the pleura. The oesophago-astrostomy was isolated from the general pleural cavity by a portion of the base of the lung and this adhesion was probably the cause of the anastomosis not closing absolutely. Thus the lung played a very important role in protecting the general pleural cavity from the possibility of communicating with the oesophago-gastric contents.

# DEPARTMENT OF TECHNIQUE

## A TECHNIQUE FOR NEURORRHAPHY

By MAJOR KENNETH BULKLEY, M.C. U.S.A.

Formerly Chief of Surgical Service, American Red Cross Military Hospital No. 1, France

THE technique of nerve suture about to be described was devised by Colonel Joseph A. Blake who first used it in the care of French wounded during the winter of 1914-1915. As neither the record of about 15 patients thus operated by him at Hôpital Militaire No. 1, or in his own records of about 20 cases operated upon subsequently by the writer by the same technique at American Red Cross Military Hospital No. 1, in France are available no detailed case histories will be attempted. The procedure was devised for and largely used on cases of musculospiral nerve division in association with compound fracture of the humerus by a gun fire.

Such cases fall into two groups. In the first group are included those patients who immediately after injury show symptoms of radial paralysis (due either to contusion or actual division of the nerve). For these the operation is not waited. The second group comprises those cases in whom the primary suture fails to give results in whom no primary suture is attempted because of the character of the wound or the infection (the latter majority) or those in whom during the progress of bone repair a section of nerve becomes destroyed by inclusion in or by pressure from bony callus. For these cases and particularly for those of the second subdivision of the group the operation is eminently suited.

The principle of the procedure depends on the utilization of scar tissue for the release of tension on the actual line of nerve suture. In the majority of instances these cases cannot be operated upon until some time after injury when bony repair is relatively complete and sinuses and concurrent infection have ceased to exist. By this time repair has almost taken place in the nerve but almost invariably with resulting bulbous end and non-union of nerve fibers. If at these apparently useless shriveled ends which prove valuable

The illustration shows the method in which they are used. The distal extremity of the nerve

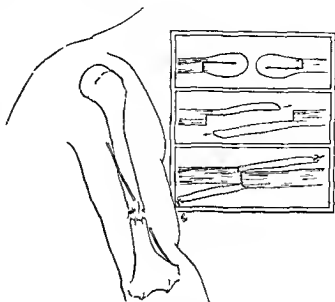
is first isolated in normal tissue in the groove anterior to the supinator longus and dissected upward until the divided extremity is completely separated from the surrounding scar tissue care being taken to preserve attached to the nerve as much of the scar tissue as possible. The proximal segment of the divided musculospiral is then sought and its end treated in a similar manner. It is essential that both ends of the nerve be sought primarily in an area free from scar tissue and that a quite considerable portion of them be freed. At times it will be most difficult to isolate the proximal segment. If not readily found a useful procedure is to make a small incision posterior to the brachial artery just below the free border of the great pectoral where the nerve will be found lying posterior to the ulna. Slight traction on it at this point will enable the operator to recognize it lower in the arm posterior or even distal to the humerus.

Before anastomosis it is well to make a new muscle bed which will separate the site of anastomosis and the contiguous portion of the nerve from callus. This is readily done by turning over the trap door of triceps muscle about a quarter of an inch in thickness and holding it in place with a few plain gut sutures. The field is then prepared for the anastomosis proper.

At right angle to the long axis of the nerve and from opposite sides incisions are made almost but not quite through its thickness. These incisions should divide normal nerve tissue but should be placed as closely as possible to the scar tissue area (see No. 1 in illustration). From the depth of each of these incisions secondary incisions are made in the long axis of the nerve almost to the extremity of the scar tissue end and the flaps turned back (see No. 2 in illustration). In this way two long flaps of tough tissue well adherent to the sheath of the nerve are obtained for traction. The extremity of each of the ends anchored usually in neighboring scar tissue but occasionally in perosteum in such a way that the divided nerve

fibers just meet without tension. We have used heavy chromic gut for these tension sutures. Care must be taken that the nerve is not rotated. Three very fine silk sutures including only the sheath of the nerve complete the neurotomy. The suture line is covered with muscle and the wound closed without drainage. The elbow is immobilized for about two weeks in a posterior molded plaster splint at an angle of about 110 degrees.

Unfortunately we have seen the end result of none of these cases as military necessity has required their evacuation before functional return could be expected. But the early results seemed good. Of the cases done by the writer in one instance only was it impossible by this method to approximate the divided ends. The loss in these cases exceeded six centimeters. A humeral resection only could have approximated them. In a second case rather severe infection followed operation. Here a bone abscess undiscovered by X Ray was encountered and opened in the callus while freeing the nerve. Neurotomy should have been abandoned but was not with the result noted.



Drawing showing author's technique

It is hoped that the procedure will be further used and end results watched as from a technical viewpoint it seems almost ideal.

## DRAINAGE IN EMPYEMA

By B. H. CAPLES, M.D., New York

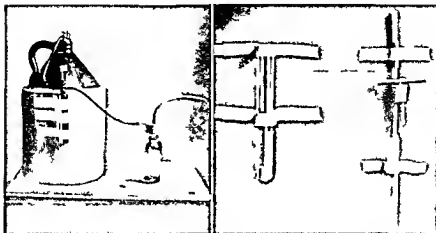
Capt. Medical Corps, United States Army, U.S.G. 1st Lt. 4th Field Hospital, G. G.

NOT only in gunshot wounds but in all operative procedures involving the thoracic cavity pneumothorax constitutes a grave menace and one that should be remedied at the earliest possible moment. So in the drainage of empyema we are confronted by the problems not only of satisfactory drainage but of the prevention or the reduction of pneumothorax and the establishment of continuous negative pressure within the chest.

In cases where the pus has become localized and adhesions have formed negative pressure although indicated is not so important as in the earlier cases where the danger of pneumothorax and subsequent lung collapse is very real.

Our operative procedure consists of a small intercostal incision under novocaine preferably in the eighth interspace in the midscapular line and the insertion of a No. 1 French red rubber catheter just within the pleural cavity or in the costal gutter. Red rubber is used as black rubber tubes do not cast a satisfactory

shadow in our X-ray plates. The catheter is held in place by means of a circular rubber flange that I am making from inner automobile tubing. The flange is one and a half inches in diameter and has a small hole punched in the center by means of a dental punch. The tip of a pair of thumb forceps is passed through this hole the forceps gently opened the tip of the catheter grasped and pulled through the opening as far as desired. Holes of varying sizes may be punched for different sized tubes. The flange should grip the tube firmly and but slightly occlude the lumen. Between the flange and the skin is placed a small pad of split gauze. Over the flange is placed another small split pad that is held in place by two strips of adhesive and the tube is firmly anchored to the patient's side by means of a strip of adhesive so that if any pull should occur on the tube it will be confined to that portion of it below the anchoring strip. If the tube fits the thoracic incision tightly there will be no leakage but if there



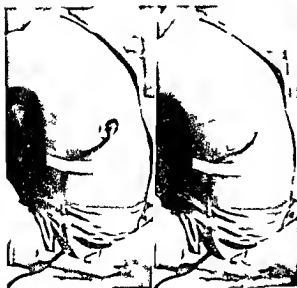
(111) A p l t i l l t b t d l M m t d l l

should be so made that it may lie over the chest, omitting the pad of gauze at the skin and trapping the flange firmly around the opening. This however should not be continued more than two or three successive days as the skin becomes irritated. The negative pressure within the chest also assists by drawing the flange tightly against the skin preventing leakage of the nitrogen of air.

The drainage apparatus the description of which follows I devised for suprapubic drainage on Dr. I. L. K. service at Bellevue Hospital but which I found with a few modifications to be suitable to the treatment of emphysema.

A five gallon jug is fitted with a two holed rubber stopper. In one hole is an I. of gla

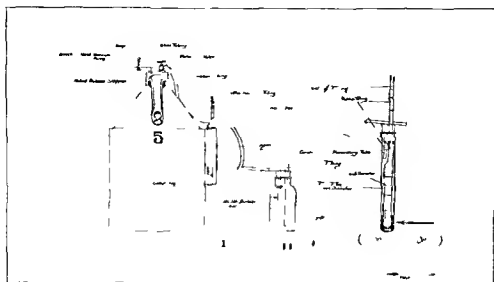
tubing the other end of which is fitted with a short piece of soft rubber tubing. The air is exhausted from the jug at this point by means of a large hand vacuum pump one hundred strokes of which produce a vacuum capable of sustaining a column of mercury 300 millimeters in height. The rubber tubing is then clamped and the pump detached. The second hole of the stopper is fitted with a metal pin valve obtained from an ethyl chloride tube by which the rate of intake of air into the vacuum is regulated. This may be adjusted to a rapid or low circulation of the fluid to be drained off. (In the absence of a valve a short piece of glass tubing with one



R b b f l d t p f d d



D d p p t t l t Th t t f d  
p t l d d f t h d b d d l l t t d



Details of the apparatus used at the hospital for the drainage of the chest cavity

end tused until only a minute opening remains or a piece of thermometer tubing, either of which will admit approximately eighty bubbles of air per minute at a negative pressure of 300 millimeters of mercury may be used.) To the distal end of the valve is fitted a piece of rubber tubing that connects with one of the lateral arms of the metal T tube which in turn connects by means of its vertical arm with the manometer that will be described later. From the other lateral arm of the T tube rubber tubing runs to the short arm of a 400 cubic centimeter Wolff bottle that is used as a collecting bottle and to the long arm of which is attached rubber tubing with a lumen of one fourth inch that connects with the thoracotomy tube.

The manometer consists of a test tube three fourths of an inch in diameter and 6 inches long fitted with a two holed rubber stopper. Through one of these holes runs the short vertical arm of the metal T tube before mentioned so that the negative pressure in the test tube is the same as that in the Wolff bottle and the chest cavity. Through the second hole of this rubber stopper runs a short piece of glass tubing the lower end of which is fitted with a short piece of rubber tubing which in turn is attached to a piece of glass tubing 4 inches long and 0.5 inch in diameter that reaches almost to the bottom of the test tube. The mercury is poured into the test tube to a height of about 1 inch immersing the lower portion of the inner tube. The manometer is tested by attaching a simple U tube manometer graduated in millimeters to the distal arm of the metal T tube. The valve is opened

slightly and as the negative pressure increases the mercury rises both in the test tube and the U manometer. At the same time the mercury is being drawn down in the inner tube of the manometer and when it reaches a given point air is drawn in through the glass tube bubbles through the mercury and slightly relieves the negative pressure. At the same time the mercury ceases to rise in the U manometer and the reading is made. If more negative pressure be desired more mercury is poured into the test tube. If less mercury may be poured out. Over the outer end of the manometer tube that opens to the open air and over the inner end of the vertical arm of the metal T tube are fitted short pieces of rubber tubing into the other ends of which are fitted short pieces of glass tubing filled with cotton. The ends of these cotton tubes are almost closed so that the cotton will not be pushed down into the mercury. The object of these cotton tubes is to prevent the loss of mercury by the violent bubbling of air through it due to either excessive positive or negative pressure. The former takes place when fluid enters the collecting bottle rapidly as for instance during the return flow after flushing the cavity the latter if the valve be opened too widely. When positive pressure occurs the mercury is forced up into the inner tube of the manometer until it reaches a point at which air bubbles through it and escapes through the cotton tube thus conserving the vacuum. The mercury acts as a liquid safety valve taking care automatically of excessive positive or negative pressure. On the outer surface of the test tube a scale in 5 mill



meter intervals is marked on adhesive plaster zero corresponding with the level of the mercury at atmospheric pressure. By this means the pressure at any given time may be read. The manometer is placed in a tube which is strapped by adhesive to the side of the junction being placed in the bottom of the tube to prevent breakage.

When starting the drainage in a given case the pin valve is opened until the negative pressure is sufficient to cause occasional slight bubbling of air through the mercury and is then left at that point. If the junction be pumped every 12 hours the valve will seldom need readjustment and a negative pressure of any desired degree may be maintained for any length of time.

For the first 2 or 3 days following thoriotomy a negative pressure of from 10 to 20 millimeters has been found to be sufficient. Later especially in cases of partial lung collapse it may be increased gradually to 40 or 50 millimeters. Not only is the cavity drained but gradual distention of the lung follows. Even though the patient does not complain the appearance of traces of blood in the discharge unless due to the manipulation of the tube is an indication for reducing the negative pressure.

This method has been adopted in our empyema wards and in a series of 31 cases thus treated there has been but one death and that in a case of bilateral empyema that had been operated upon 4 weeks before the negative pressure apparatus was applied and who had developed

pneumothorax and a general sepsis. Of the other cases 8 have completely healed and are up and about the wards and have no symptoms of a reaccumulation of fluid after a period of several weeks. Five have such small cavities and so little drainage that the negative pressure has been discontinued. The other 17 are draining satisfactorily, have no pneumothorax and are all in good condition. The average total period of drainage where negative pressure was used from the time of operation has been 6 weeks.

The apparatus is portable, easily made, the parts inexpensive and it requires but a minimum of attention. Although by the use of Y tubes 2 or more cases may be drained by a single apparatus it has been found more satisfactory to have a separate one for each patient.

A satisfactory vacuum pump may be made from a bicycle or automobile pump by simply reversing in the plunger and valve.

Captain Frederick Knowles, assistant surgeon at U. S. General Hospital No. 8, informs me that he is also using this method of drainage in the treatment of empyema with good results.

At the present time 8 weeks since the above was written 26 of the above cases are healed in good condition and show no signs of reaccumulation; 3 are so nearly well that negative pressure has been discontinued and 2 has been transferred to another hospital.

I h t l l dg my d b t d t s h  
O f h i ce n d ng th d n ge pp  
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## GRAPHIC PRESENTATION OF FINGER DEFORMITIES<sup>1</sup>

By A. GOTTLIEB, M.D., SENIOR

IN the treatment of joint deformities difficulties are frequently encountered in reporting the gain of motion. For the large joints such as the knee and elbow, one of the many goniometers, fleximeter, or any one of the many instruments which have been devised to register the amplitude of motion of joint can be used with more or less accuracy. For the carpometacarpal, metacarpophalangeal and the interphalangeal joints these instruments do not give the desired satisfaction.

A very simple and useful method has occurred to me for the measurement of the small joints. This method requires neither expensive appara-

tus nor is it exposed to the variation by the difference of applying the arms of the goniometer to the surfaces above or below the examined joints.

As soon as the patient presents himself for treatment a goniometer is made which holds the active flexion and extension of each and every finger. The measurements are repeated about every 3 weeks and recorded on the chart as demonstrated on Figures 1 and 2. The headings on the figures represent the range of motion of the patient's normal finger; of the other well hand. Should there be injury to both hands a tracing can be made from the finger of an in-

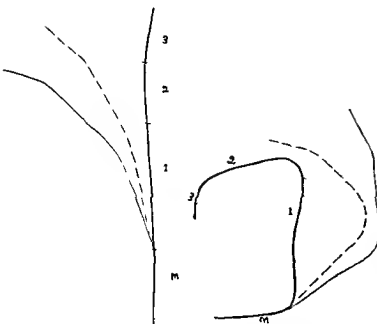


Fig 2 (at left) Fourth finger in extension showing gradual improvement. —Normal contour of third finger in extension. ---In extension June 8 1918. ---In extension July 20 1919.

Fig 3 Fourth finger in flexion showing gradual improvement. —Normal contour of third finger of left hand. ---June 8 1918. ---July 20 1918. 1 First phalanx 2 second phalanx 3 third phalanx m metacarpal

dividual of the same age and sex. The outlines of flexion and extension of the normal finger serve for the purpose of easy comparison with the tracings of the deformed fingers.

For this graphic presentation the only materials necessary are the lead tape pencil or colored pencils if so desired and paper. The lead tape used is about 10 centimeters long and 4 millimeters thick. In consequence of its malleability the tape conforms exactly to the shape of the deformed finger.

The curved tape which represents the deformed finger is placed on a sheet of paper which has the outline of the normal finger and a tracing is made along the line of the tape. Either colored pencils or one of the broken lines are used to record the improvement on the different dates of the examination.

For the purpose of demonstration I quote the following case:

June 8 1918 Mr A was referred to me by Dr B to restore function in the right hand. Patient sustained a severe injury of the hand February 7 Contusion and lacerations of the third and fourth fingers fracture of the middle and distal phalanges of the third finger and wounds on the dorsum of the hand were present. Amputation of the fractured phalanges as performed when first aid was applied. Infection set in the stump and lymphangitis and tenosynovitis in the hand and forearm. The patient

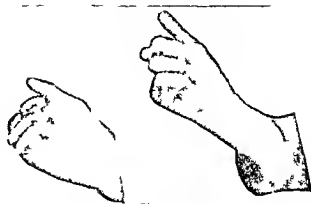


Fig 3 Active flexion June 8 1918 active flexion July 20 1918

has stiff fingers and wrist atrophy of the muscles of the forearm and limitation of motion in the elbow joint. Physiotherapy was instituted. Treatment was begun June 7 and was ended July 10 1918 when the patient was discharged able to return to work. The charts represent the fourth finger only and are to serve as an example of this method of graphic presentation of finger deformities.

These goniograms have been useful in reporting the improvement which has been gained in the course of treatment to the surgeon who has referred the patient to me.

A carbon copy of the chart is sent to the surgeon as often as required. If it is desired to report the improvement from date to date in figures of degrees it is easy to designate the angle by means of a fleximeter. For the metacarpophalangeal joint the arms of the fleximeter are placed on the lines corresponding to the metacarpal and the phalanx on the chart; this will give the angle of the metacarpophalangeal joint. To express in degrees the angle formed by one of the phalangeal joints one arm is placed on a line corresponding to one phalanx while the other on a line parallel to that of the next date. The angle is read off on the dial of the instrument when the arms are in their proper places. By means of the goniogram one is able to report the amplitude of movement in each joint very accurately. Measure by means of the tape the maximum of flexion active and passive of the joint trace these corresponding lines on paper measure the maximum of extension and trace these lines on the same paper so that the lines which represent the distal surface of the joint should overlap. The angles thus formed are the angles of active or passive motion of the joint.

This same method can be used for the measurement of motion in the other joints of the skeleton with the same exactness and it is preferable to a photographic reproduction and to records obtained by the goniogram of fleximeter.

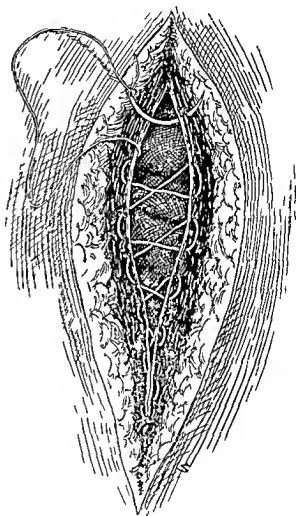
## A SIMPLE EFFECTIVE SUTURE FOR CLOSURE OF DIFFICULT PERITONEAL INCISIONS

By JABEZ N JACKSON MD FACS KANSAS CITY MISSOURI  
Ch FS geo Ch to Chur h H p tal

THE closure of peritoneal incisions is at times a matter of much difficulty. This may be due in instances to tension resulting from muscle retraction and in other instances is due to thinness and friability of the peritoneum itself. This is particularly true in incisions of the upper abdomen. Many more or less complicated suture methods and devices to overcome these obstacles have been suggested. We have tried most of them with varying degrees of dissatisfaction.

About three years ago rather accidentally we fell into the use of a cross buck mattress suture. It is exceedingly simple and has proved altogether satisfactory. We do not see anything especially new in it though we have never seen suggested its use in this service. However in view of the extreme satisfaction it has given us we feel justified in calling it to the attention of others.

First a simple transverse suture at the lower (or upper) end of the wound is tied. It is a continuous suture. The needle on the long end of the suture is now introduced from without inward about one eighth to one quarter inch above the primary suture. It passes obliquely forward and is brought from within outward at a point about the same distance forward of the point of entrance. It is now brought backward to a point opposite the beginning and introduced on the opposite side from without inward. Again obliquely it is advanced and brought from within outward one eighth to one quarter inch forward of the beginning point of introduction. It is now drawn taut and the next stitch begun. It is thus an X or cross buck mattress stitch. Where there is much tension or a very friable peritoneum a liberal bite of muscle may be taken in each stitch. When each stitch is drawn taut it is remarkable that it does not cut out. The peritoneum is also everted leaving no raw surfaces on the inside.



Cross buck mattress

## A METHOD FOR MARKING OUT VARICOSE VEINS FOR OPERATION

By GEORGE P COOPERNAIL

M J M C U S A U S A G I H p l i N o L k w d N w J y

IN the operation for removal of varicose veins of the legs the enlarged veins can be much more easily found if they are marked out on the skin previous to the operation the patient standing and sometimes it is well to cord the leg but not too tightly in order to distend the veins. When the patient is lying down and under an anæsthetic the veins are more or less collapsed and in some cases where there is much subcutaneous fat it is quite difficult to find them. The operation most commonly performed today probably is the Mayo stripping operation and resection of veins that cannot be stripped. In the Schede operation the marking of veins would be of no special value but this operation at the present time has become obsolete. Up to a few years ago I marked them out with a 2 per cent solution of silver nitrate which leaves a black mark over the veins but if the skin is painted with iodine at the time of operation it is not very distinguishable.

I have had several accidents with the use of solution of nitrate of silver in the hands of internes as it does not blacken the skin at once after it is painted on. The internes thinking the solution would not make a mark proceeded to mark them out with a nitrate of silver pencil the result being disagreeable burns. Several of my surgical friends have had a similar experience. The idea occurred to me of finding some other way of marking after these accidents. After trying out many

of the colors and dyes I found brilliant green an aniline dye in an aqueous solution most satisfactory.

The veins should be marked out the day before operation and let dry before the clothing touches them. And at the time of operation they can be painted with one or two coats of iodine. The vessels will show beautifully through the coats of iodine as green intensifies almost all colors. After the skin has been marked with the green it is almost impossible to wash it off with alcohol turpentine ether etc. It takes several weeks for the stain to wear off.

There are a number of distinct advantages in marking out the veins for operation. You can readily locate all the vessels and save much time searching for them. It enables one to perform a more thorough operation removing all enlarged and tortuous vessels. With the vessels marked out it is possible to follow them with parallel incision which will give you better access to adherent and tortuous vessels. Following the parallel incision there will be less scar. Most operators make the transverse incision in order to locate the vessels more readily.

I cannot recommend this method of marking varicose veins too highly and I am sure that if tried it will be found satisfactory.

Captain T D Buchanan Medical Corps after seeing a number of cases operated on by this method suggested that it would be a good way for marking the scalp in intracranial operations.

# CORRESPONDENCE

## FULL TERM ECTOPIC PREGNANCY

To the Editor I am submitting the following case history on account of its rarity and the unusual length of time before delivery.

Mrs. B. age 35 second pregnancy. Three years ago the patient had a miscarriage at 5 months. She has always been well. Her last menstrual period was in February 9, 1905. Since that time she has been well and has not suffered from nausea or vomiting. She has never had a vaginal discharge or any signs of bleeding.

The patient was first seen May 10, 1905 at which time her heart and lungs were normal. Vaginal examination showed the cervix slightly softened and the uterus seemed to be pushed to the left side. She was not seen again until the first part of September when she was having considerable indefinite abdominal pain which made it impossible for her to lie on her back without intense pain. Vaginal examination did not show any present pregnancy. Abdominal palpation showed the fetus in the transverse position.

On November 9 the patient had a few pains and passed a small mass about the size of a lemon. This was not seen as it was not saved for examination. She refused to enter the hospital but refused to go. She was quite comfortable from this time until the first of January, 1906 when she had a severe attack of omphalitis. Fetal movements were present. The urine was negative.

Finally the last week in January she consented to go to the hospital for operative treatment.

January 30, 1906. The patient was in fairly good condition. She was able to walk without very much discomfort. X-ray examination of the abdomen showed the fetal head just above the rim of the pelvis on the left side. The buttocks were above the umbilicus. The cervix was small and retracted.

On February 1, 1906 under ether anesthesia a midline incision about 7 inches in length was made. The sac was found adherent to the peritoneum. The adhesions were separated and the sac delivered. The sigmoid was adherent and spread over the upper portion of the sac. The sac was opened and a well formed baby weighing 8 pounds was delivered. All the blood sinuses were closed and there was very little bleeding.

The sigmoid and ureter were then separated from the sac with a great deal of difficulty and the mass removed from the left horn of the uterus. A small portion of the fundus of the uterus was removed which was repaired with several catgut sutures. The wound was closed by layers with catgut silk suture and silk. No drainage.

The patient made a good recovery and 6 weeks later walked a mile to the office without any discomfort.

FRED R. HUTCHINSON, B.S., M.D.

St. Louis, Mo.

## HÆMOLYTIC STREPTOCOCCUS AND INFLUENZA IN LABRADOR

To the Editor I enclose an article in SURGERY, GYNECOLOGY AND OBSTETRICS on the delirious though certainly in section of a living child after the death of the mother. It occurred to me that the following might be of interest. A very urgent request came to me the other day in this country here comes a case so very rare to look at a dying bear. I found the cow so far I could tell dying. It was riddled with tuberculous for the week past had not been able to stand and it appeared to be quite in a great deal so I ordered it to be killed at once. This was done by shooting it through the forehead twice. It lay over dead and after the lapse of a minute or so I opened the belly to try to save the calf. This proved entirely successful the calf only needed a little stimulation to breathe. To my surprise however I found after reviving the calf that the uterus contained a sec-

ond calf which had come into the small space and semi-damaged. I had not noticed before. The calf was also removed and revived. This was no over a month ago and both are now thriving well and likely to be good healthy animals as they have never taken milk from their dam.

The epidemic of influenza in Labrador has been so serious as nearly to wipe out the population especially the Eskimo and Indians. I have no detailed reports yet for our most northerly hospital except that hundreds have died. If the hæmolytic streptococcus is the determining factor then it cannot be that in these cases the bacteria caused milk which is one of your contributions states for the case is not a single case on that coast and none of the natives uses milk.

WILFRED T. GRENFELL, M.D.

St. Anthony, Newfoundland.

# Clinical Congress American College of Surgeons

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NINTH ANNUAL MEETING  
NEW YORK CITY  
OCTOBER 20 TO 24, 1919

# COMMITTEE ON ARRANGEMENTS

J BENTLEY SQUIER CHAIRMAN

## New York City

C G BANDLER  
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EDWIN BEER  
J A BLAKE  
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CORNELIUS G COAKLEY  
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WILLIAM B COLEY  
ROYAL S COPELAND  
WILLIAM DARRACH  
ASA B DAVIS  
JOHN DOUGLAS  
CHARLES N DOWD  
WM A DOWNES  
JOHN W DRAPER  
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CHARLES A ELSBERG  
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AUSTIN FLINT  
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HENRY D FURNISS  
VIRGIL P GIDNEY  
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JOHN A HARTWELL

IRVING S HAYNES  
W P HEALY  
WILLIAM T HELMUTH  
CHARLES GORDON HEYD  
JAMES M HITZROT  
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JEROME LYNCH  
JAMES W MARKOE  
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FRANCIS S MATTHEWS  
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J F MCKERNON  
WILLY MEYER  
SETH M MILLIKEN  
J J MOOREHEAD  
A S MORRISON  
A V MOSCHOWITZ  
ALEXANDER NICOLL

F R OASTLER  
ALFREO T OSGOOD  
J R PAGE  
C H PECK  
WENDELL C PHILLIPS  
EUGENE H POOL  
JOHN ROGERS  
REINALD H SAYRE  
HENRY MANN SILVER  
THOMAS A SMITH  
FREDERICK E SONDERN  
GEORGE D STEWART  
W E STUDDIFORD  
PARKER SYMS  
ALFRED S TAYLOR  
HOWARD C TAYLOR  
PERCY R TURNURE  
H H TYSON  
ANTOINE P VOISLAWSKY  
JOHN B WALKER  
CHARLTON WALLACE  
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JOHN E WHEELS  
JAMES N WEST  
FREDERICK WHITING  
ROYAL WHITMAN  
PERCY H WILLIAMS  
GEORGE WOOLSEY

## Brooklyn

HUBERT ARROWSMITH  
R M BEACH  
ELLIOTT BISHOP  
BION BOGART  
W F CAMPBELL  
C G CRANE  
G L DEELEY  
H BECKMAN DELATOUR

ROBERT L DICAINSON  
JAMES M DOWNEY  
WARREN L DUFFIELD  
RUSSELL S FOWLER  
F C HOLDEN  
ALBERT M JUDD  
WILLIAM LINDER  
S H LUTZ

JOSEPH P MURPHY  
JOHN OSBORN POLAK  
J S READ  
RAYMOND P SULLIVAN  
WALTER TRUSLOW  
LUTHER F WARREN  
J S WATERMAN  
RICHARD W WESTBROOK

## EXECUTIVE COMMITTEE

GEORGE D STEWART CHAIRMAN

J A BLAKE  
GEORGE E BREWER  
CORNELIUS G COAKLEY  
MARTIN COHEN  
J B CLEMENS  
WILLIAM DARRACH  
JOHN DOUGLAS  
WILLIAM A DOWNES  
ARTHUR B DUEL  
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FREDERICK C HOLDEN  
E L KEYES JR  
GEORGE W KOSMAK  
A V S LAMBERT  
J F MCCARTHY  
J P MURPHY  
J F MCKERNON

F R OASTLER  
C H PECK  
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CHARLTON WALLACE  
GEORGE GRAY WARD JR

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

WILLIAM J. MAYO M.D. President

ALBERT J. OCHSNER M.D. Treasurer

FRANKLIN H. MARTIN M.D. Secretary General

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## THE CLINICAL CONGRESS IN NEW YORK CITY

THE ninth annual meeting of the Clinical Congress of American College of Surgeons in New York City comes at an opportune time. The return to their homes of the scores of medical men who have been in military service together with the marked expansion in hospital facilities during the war and subsequent to the armistice have brought us new enthusiasm for this second visit of the Clinical Congress to New York.

The marked development in the surgical and chemical sterilization of wounds incident to war surgery, the larger and more amplified technique of bone surgery, the new impetus given chest surgery and the collective experience of the various surgeons engaged in war work will all have an expression in the forthcoming Congress.

In addition there is the desire of the New York surgeons to have with them again the Fellows of the College of Surgeons and to take up the problems of civil surgery. Special arrangements are being made in all the metropolitan hospitals in greater New York as well as in private institutions to care for the unusually large attendance which the profession of New York expects. Of particular value will be the careful segregation of clinics so that it will be possible for the visiting surgeons to select any or all of the varied surgical fields on different days and visit the various clinical groups in the city.

It may be said that the collective clinical material of greater New York is not equalled by any other city in the world and the remarkable progress made in the last few years in the hospitalization in adequate and extensive departmental service has brought about a more scientific arrangement for the treatment of surgical cases. In no

small measure the impetus to this improved and advanced hospital work is due to the standardization first initiated and subsequently carried out by the College of Surgeons and the meeting of the Clinical Congress in New York this year will demonstrate and show further possibilities for hospital progress in the various branches of surgery and allied specialties.

The amplified traction systems of the city have brought the outlying hospitals into closer touch with the center of the city and it is now possible to visit any of the hospitals in greater New York starting from headquarters at the Waldorf Astoria within thirty to forty five minutes. Fortunately for the concentration and observation of clinical material the major groups of hospitals are located within ten to fifteen minutes of the Waldorf Astoria via the surface, elevated or subway systems. In fact the principal hospital of the city are located within a relatively small area with headquarters of the Clinical Congress as the center.

The recent addition to the hotel facilities of New York of a half dozen large hotels means that the visitors will have less difficulty in reserving adequate accommodations.

The profession of New York, united under able leadership and by means of adequate committees of able men has been able to arrange and systematize the surgical work of the city during the week of the Congress so as to cover every department of surgical endeavor emphasizing diagnosis, operative technique and the after care of the patient.

The New York Committee is united in the keen desire to place before the visiting surgeons their maximum surgical effort.



## HOSPITAL STANDARDIZATION

The constructive work of the College centers in its program of hospital standardization. Each fellow of the College is a part of that program. Its success depends largely upon the extent to which the fellows first enter into the work themselves and second enlist the co-operation of hospital trustees, physicians and surgeon superintendents, laboratory workers, nurses and the interested public in the betterment of hospital. On Friday, October 4, during the morning and afternoon, a complete review will be made of the work of the College in hospitals. This review will include a statement of what the College has done, illustrated by lantern slides. The minimum standard will be explained and the list of hospitals which met this standard will be presented. The problems which arose in connection with the work will also be discussed and finally the practical application of the program of the College as it is now being worked out in a group of hospitals will be presented.

The afternoon session will be devoted chiefly to a general discussion of the subject matter considered at the forenoon session. Attention will also be given during the afternoon to the program of the College for the ensuing year.

These meetings will be held in the ballroom of the Waldorf Astoria. The following program is self-explanatory.

## MORNING SESSION 9 O'CLOCK

Instructor: The Light of Health WILLIAM J. MAYO  
M.D. President of the College

Standardization of the Hospital CHURCHILL B. MAYO  
M.D. President of the College

Work of the Hospital JOHN G. BOWMAN  
Director of the College

Practical Application of Hospital Standards to  
the General Hospital T. M. McEACHRAN  
M.D. Superintendent

At the Women's Hospital New York GEORGE  
GRAY W. ED. JR. M.D. Chief Surgeon

At the St. Vincent's Hospital L. A. GEIGES, ED. JR.  
THOMAS D. LLOYD, M.D. Surgeon in Charge

At Mt. Sinai Hospital Cleveland FRANK E. CHAPMAN  
M.D. Superintendent

Discussion

## AFTERNOON SESSION 3 O'CLOCK

Continuation of the Hospital Standardization  
Program of the College for the ensuing year

## GENERAL PLANS FOR THE NEW YORK MEETING

Following the general plan of previous sessions, the morning and afternoon hours of each of the five days will be devoted to operative clinics and demonstrations. A list of the clinicians and institutions that are co-operating to provide the clinical entertainment is published in the following pages. The real program of the Congress, however, is that bulletined each afternoon at headquarters, which gives in complete detail the cases to be operated upon and demonstrated in the several clinics on the succeeding day. Printed programs containing the schedule of clinics and demonstrations, together with announcements as to evening and other general sessions are published each morning.

The preliminary program of the evening sessions to be held in the ballroom of the Waldorf Astoria will also be found in the following pages.

The Committee on Arrangements is preparing a schedule of clinics and demonstrations which will fully represent the clinical activities of greater New York. All departments of surgery are to be represented, including gynecology, obstetrics, urology, orthopedics, surgery of the

eye, ear, nose, throat and mouth, roentgenology, experimental surgery, surgical pathology, etc.

The Committee is also arranging for a series of clinical demonstrations before large groups to be held each afternoon in some conveniently located hall or amphitheater. At these demonstrations, surgical problems of present day interest will be discussed with the aid of exhibition of cases, specimens, lantern slides, charts, etc. A number of the visiting surgeons have been asked to participate in these demonstrations.

## LIMITED ATTENDANCE—ADVANCE REGISTRATION

The popularity of these clinical meetings has proven so great that it has been found necessary in recent years to adopt the plan of limiting the attendance and requiring advance registration. A survey of the operating amphitheatres, lecture rooms and laboratories in the hospitals and medical schools as to their capacity for accommodating visiting surgeons has been made and the limit of attendance based thereon. Visiting surgeons are thus assured that there will be accommodations at the clinics for all who receive

cards When the limit of attendance has been reached through advance registration no further registrations will be accepted

To each surgeon registering in advance a formal receipt for the registration fee is issued which receipt is exchangeable for a general admission card at headquarters upon his arrival This card which is non transferable must be presented to secure clinic tickets and admission to the evening meetings Headquarters at the Waldorf Astoria will be open for registration on Sunday October 19th for the convenience of members arriving in the city on that day The clinical program for Monday will be bulletined at headquarters on Sunday and tickets for Monday's clinics will be issued as visiting surgeons register

#### HEADQUARTERS

General headquarters for the Congress will be at the Waldorf Astoria Hotel where the Grand Ballroom Astor Gallery Myrtle and East Rooms together with other large public rooms and foyers have been reserved for the use of the Congress for its registration and ticket bureau bulletin rooms etc The Grand Ballroom will be used for the general sessions afternoon and evening The Hotel McAlpin with its large number of guest rooms under the same management as the Waldorf Astoria and located in the same block will be able to take care of a very large number of the visiting surgeons There are many other first-class hotels in the immediate vicinity but because New York hotels are usually well filled in October it is urged that surgeons who expect to attend the Congress make early reservation of hotel accommodations

#### CLINIC TICKETS

Attendance at all clinics and demonstrations is controlled by means of special clinic tickets the number of tickets issued for any clinic or demonstration being limited to the capacity of the room in which the clinic or demonstration is to be given As a general rule one may have two tickets for each day one for a morning and one for an afternoon clinic but for certain clinics where the accommodations are limited and the

demand for tickets is heavy the rule will be that a visitor may have but one ticket for such clinic during the week The use of clinic tickets has proven an efficient means of providing for the distribution of visitors among the several clinics and insures against overcrowding

Clinic tickets will be issued at headquarters each morning at 8 o'clock for the clinics and demonstrations to be given that day a complete schedule of the day's clinics having been posted on the bulletin boards on the afternoon of the preceding day After the program has been posted reservations for clinic tickets for the next day's clinics may be filed the tickets to be issued the next morning Printed programs will be issued each morning containing the complete clinical program with announcements of the evening session business meetings etc

#### REGISTRATION FEE

A registration fee is required of each surgeon attending the annual clinical meeting the receipts from registration fees providing the funds with which to meet the expenses of preparing for and conducting such meetings so that no financial burden is imposed upon the members of the profession in the city entertaining the Congress

#### COMMITTEES ON CLINICS

General Chairman—CHARLES GORDON HEYD  
General Surgery—CHARLES H. PECA Chairman  
Orthopedic Surgery—CHARLTON WALLACE Chairman  
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Laryngology—CORNELIUS G. COARLEY Chairman LEE M. HIRD Secretary  
Otolaryngology—ARTHUR B. DUEL Chairman JOHN RUDOLPH PAGE Secretary  
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Laboratory Demonstrations—FREDERIC L. SONDERMAN Chairman  
X-Ray Demonstrations—HARRY MILES IMBODEN Chairman  
Brooklyn Clinics—O. I. HUMPHSTONE Chairman  
Publicity—GEORGE W. KESSEL Chairman  
Finance—J. F. ERMANN Chairman

## PRELIMINARY CLINICAL SCHEDULE

## NEW YORK HOSPITALS AND CLINICIANS

## GENERAL SURGERY

BELL VUE HOSPITAL—N. th n W Gr n Eug ne D pe  
J h i C A gh F W Cr He D td G d n  
G A C lu Fr d M ntgom y J hn R g s  
G g D St t W H Ba b I A Sm th V  
c t U d a  
BROAD STREET HOS I L—P be t T M tr T F  
S H A J dd J hn H ly  
CITY H S IT L—Natha W Ge J eph Pobe tso  
D A m t g  
CORREC I AL H S AL—W Tr G bb F nk C  
Ye ma W H St t f d  
FLOWE H SP L—L R k ufman A s n H B g  
h m E W Kell g O R n Bo t z G g  
W Lutt  
FRENCH HOSP AL—J P H t M I Blank  
GOUVENEUR HOSPI L—D I keil g Alb t Sell n  
HAINEM NN H SP TAL—G W Rob t W C C mp  
H A I st r Spr g e C l to J H Go be H B  
Saff rd  
HARLEM HO ITAL—H A H ub ld  
LEVOY HILL HO P TAL—W Hy Mey r F Kamm er F  
To k  
MEM R L HOSPITAL—H I Jan y William B Col y  
Benj m n S Ba g r G H Mall tt Ha ld  
C Baly  
METR POLIT N H S ITAL—W Ham F H n n G S  
Ha nton C I b g J eph H F b s Ralph S  
W d M W McD ff  
MT SIVA HOSP L—A A B Ri had d Le hn  
J h C A C st r Ab h m J B l r c l m n  
W M t W W W m Thalhm Clals  
A El b g Alfed S Ta l Ab h m O Wil ly  
NEU L K IN TUTE—C A Fl b g A S T y  
NEV Y K Ho TA—L L C bso J M H t t C  
E T r S Erdma J A l t E M H k  
POLYCLIN C H SPIT L—J hn A Wyeth William St rpe  
J me M Ly h  
POST GRADU TE H SP TAL—J I Edm nn S Li yd E  
W P i o C Heyd J J W b d  
PRES T I N HO TA—V S L mb t E T Pul  
Hugl A h l A O Whppl J M Ha fo d  
I b be Ha k s J m A Co ad n  
ROO E LIT H t L—Ch I H P k s th M l k  
Ch l N D d f W H t k k  
HOSPI L F R RU URED AND CRIP LED—W Ham B  
C l y J P H g t  
SKIN AND CAN ER HOS IT L—St ff  
S FR N H PI AL—J h Ro r s W lt C Cramp  
F n Edg t n A th n H r n  
ST IUK H SPIT L—Will m A D W M t n  
N th W Ge F a k s Math J h D l s  
W t ld S lley  
ST MARY H S IT L—Fr k s M thew Ed d  
Tue d h C l l E f s  
ST VINCENT HOS ITAL—G e D St n rt

## GYNECOLOGY

BELLE UE H SP AL—W m E Studd f d  
BETH ISRAEL H R L—S W B d M R b  
CITY H SP T L—H S St a s  
FORDHAM HOSP AL—W m P H ly  
HAINEMANN HO I A—W lte G Crump

HALEM H PITAL—I S H ynes A Stei  
IT LI V H IT L—M C tr r  
LE V H SP TAL—G S ligma n  
LE VOY HILL H SPIT L—F nk R Oa tlr G S ebg  
m n A St n  
LINCOLN H SP TAL—F ank R O d Ed d T Hull  
M S A H SP AL—H N V b rg J eph B tt e  
P RE H S IT L—I S Hayn s  
POLACINE HOSP L—C G Chld L J L d sky T  
H M n J C F ylo  
POST GRADU TE HOS IT—S W B dlr J N West  
H D I i H a d C Tayl r William P H ly  
SEO NE HO P AL—Staff  
W M NS H SPITAL—L Roy B Dougal B ll G  
G W d Jr He m n C ad

## OBSTETRICS

LYT G-IN HOSPITAL—A a B D i C F Jell n bau  
P M Phc n W A M n H M Ratlff  
MANHATT MATL R i Ho PIT L—J C Edg Aut  
H t Da d B H C B ly Wm M Fo d  
Fr de ck C P e H C Will ms

## ORTHOPEDIC SURGERY

BELL VUE HOSPITAL—Staff  
HOSITAL F R I G TU E ND CRIPPLED—Staff  
Ho t L r R DE RMITES AND JOINT D EAS s—  
St ff  
NEW V E O HOPED C HOSPITAL—St ff  
POS CR DUAT H SPITAL—St ff  
ST LUKES HOSP L—Staff

## UROLOGY

BELLEUE H S ITAL—F L Key s Jr Alfed Osgood  
L ym d St s B S B g O S Lo ly  
FLO ER H TAL—Sp que C l t k n ka for d  
GOOD S M TAN HO P TAL AND DISPEN a—G W  
S i bu e  
L N V H L H SPIT L—J seph J A ch  
MEM RIAL H SP—B S b r r  
METR POL V HOS IT L—Sp gu Ca leton  
MT SIVA H SPIT L—Id n B Le b g A Hy  
m n M t W W  
NEW YORK HOSP L—O S Lo ly M S T de  
Chals J Goel  
POST GRADU TE HOS L—J Be tly Sq J ph F  
McC th Cl n G B ndl Jam P ders n  
Stead y R W druff C g F Cah l  
PRE TERIAN H ITAL—J B ndy Sq er Jo ph F  
M C th Cl G Ba d  
ST M k H S t L—V r d C P ders I Ackerm  
WEST SID DISPENS RY—F d B rhoif  
WOMAN HOSPITAL—H G Bugbe F E Dub

## OPHTHALMOLOGY

B L EVUE HOSPITAL—Ch le H M y J l us W lff  
HA M F E A D ER HOS—Ch l B P M dng  
KN M M RIA HO IT L—V ld k apf E n  
T k H r H Ty n  
MAN T L E F ER AND THR AT HOS ITAL—J m  
W C sell J hn R Sh E Th m I r a k  
V H IT L D k y Alfr d D M t d f G o g  
R H e h be t W W t t

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

MT SINAI HOSPITAL—Carl Koller  
 NEW YORK EYE AND EAR INFIRMARY—George S Dixon  
 R G Reese George H Bell Walter E Lambert John  
 E Weeks John M Wheeler L W Callan  
 NEW YORK OPHTHALMIC HOSPITAL—George A Shep  
 ard Dr Healy Dr McEane Charles H Hellmich  
 Dr Lloyd De Wayne Hallett  
 POST GRADUATE HOSPITAL—Ellice M Alger M Cohen  
 A Ldv and Davis Dr Troncoso Dr Meeker  
 ROCKEFELLER INSTITUTE—Dr Noguchi  
 ST LUKE'S HOSPITAL—Colman W Cutler Alfred Wiener

## LARYNGOLOGY

BELLEVUE HOSPITAL—E L Pratt L M Hurd C G  
 Coakley J D Kernan Jr  
 GOUVERNEUR HOSPITAL—W W Carter  
 MANHATTAN EYE EAR AND THROAT HOSPITAL—L A  
 Coffin John E MacKenty J D Kernan Jr O L  
 Monroe W W Griffin J A Mulholland William M  
 Dunning E V Hubbard Harmon Smith I W Voor  
 hees E R Faulker  
 NEW YORK EYE AND EAR INFIRMARY—J J King John  
 M Hall N R Dann John McCoy T L Saunders  
 L D Alexander  
 NEW YORK THROAT AND NOSE HOSPITAL—L M  
 Hurd  
 POLYCLINIC HOSPITAL—J H Abraham H L Lynah  
 H L Gatewood M D Lederman D S Dougherty  
 A M Anderson  
 POST GRADUATE HOSPITAL—B Douglass C A Frelich  
 J B Ferguson J L Maybaum

## BROOKLYN HOSPITALS AND CLINICIANS

### GENERAL SURGERY

BROOKLYN HOSPITAL—H F McChesney N P Rath  
 bun R W Westbrook Walter Truslow  
 HOLY FAMILY HOSPITAL—J M Downey W A Pascual  
 JEWISH HOSPITAL—J Linder William Linder G I Mil  
 ler J B Bogart  
 KINGS COUNTY HOSPITAL—J B Boart  
 LONG ISLAND COLLEGE HOSPITAL—W F Campbell J  
 S Wight H C Fett H H Morton  
 METHODIST EPISCOPAL HOSPITAL—R S Fowler H F  
 Graham C H Goodrich A H Bewart

### GYNECOLOGY

BETHANY DEACONESS HOSPITAL—H A Wade  
 CONYER ISLAND HOSPITAL—V A Robertson  
 BROOKLYN HOSPITAL—R H Pomeroy  
 BUSHWICK HOSPITAL—W A Jevett  
 GREENPOINT HOSPITAL—F C H Iden  
 WYCKOFF HEIGHT HOSPITAL—F Weisbrod

ST LUKE'S HOSPITAL—A P Volslawsky L T Perrault  
 W M Hunt D B Delevan  
 VANDERBILT CLINIC—John Leshure E L Pratt  
 UNIVERSITY AND BELLEVUE MEDICAL COLLEGE—Arthur  
 J Huey John McCoy  
 WILLARD PARKER HOSPITAL—H L Lynah

## OTOLOGY

BELLEVUE HOSPITAL—W C Bowers T L Saunders  
 Lee M Hurd  
 MANHATTAN EYE EAR AND THROAT HOSPITAL—Philip  
 D Kerrison John D Richards James G Dryer Dr  
 Pike Wendell C Phillips J Clarence Sharp Freder  
 ick M Law Isidore Friesner Dr Straus Alfred Braun  
 Warren C McFarland John R Page  
 NEW YORK EYE AND EAR INFIRMARY—Edward B  
 Dench Charles E Perkins John A Robinson Dr  
 Scutter George S Dillon Gorham Bacon Edward B  
 Sutphen John M Hall Frederick Whiting Robert  
 Lewis Hugh B Blackwell William Ferguson James  
 J King John McCoy Truman L Saunders A U  
 Callisen  
 POLYCLINIC HOSPITAL—James M Smith Dr Stevens  
 George E Davis  
 POST GRADUATE HOSPITAL—Perry Schoonmaker War  
 ren C McFarland Edgar H Fair J H O Connell  
 Clarence H Smith H Beatrice Brown  
 ST LUKE'S HOSPITAL—Edward B Dench Wesley C  
 Bowers Charles E Perkins

HOLY FAMILY HOSPITAL—V L Zimmerman  
 JEWISH HOSPITAL—V M Judd A Bonner J O Polak  
 L Schartz  
 LONG ISLAND COLLEGE HOSPITAL—C S Hyde W P  
 Pool J O Polak  
 METHODIST EPISCOPAL HOSPITAL—O P Humpstone R  
 M Beach  
 ST CATHERINE'S HOSPITAL—C A Gordon  
 ST MARY'S HOSPITAL—V L Zimmerman  
 SAENE SANITARIUM—L G B Idwin  
 WILLIAMBURG HOSPITAL—J P Glynn H A Wade

## EYE EAR NOSE AND THROAT

BROOKLYN HOSPITAL—C G Crane W S Slattuck  
 JEWISH HOSPITAL—V M Ho e A Hayman  
 LONG ISLAND COLLEGE HOSPITAL—A J Keenan H M  
 Smith  
 METHODIST EPISCOPAL HOSPITAL—P H Sturges

## PRELIMINARY PROGRAM OF EVENING SESSIONS

IN THE BALL ROOM OF THE WALDORF ASTORIA AT 8 P M

*Presidential Meeting Monday October 20*

Address of Welcome J BENTLEY SQUIER MD New York Chairman of Committee on Arrangements  
 Address of retiring president JOHN G CLARK MD Philadelphia  
 Inaugural address WILLIAM J MAYO MD Rochester Minn  
 Introduction of foreign guests SIR ROBERT JONES Liverpool MAJOR GILLIES R A M C Sidcup Sir  
 ANTHONY BOWLBY London  
 SIR ANTHONY BOWLBY K C B K C M G K C V O F R C S London Fractures of the Femur  
 Discussion F N G STARR MD Toronto

*Tuesday October 21*

HARVEY CU HING MD Boston Brain Tumor Statistics  
 Discussion CHARLES H FRAZIER MD Philadelphia ALLEN B KANAVEL MD Chicago CHARLES  
 A LLSBERG MD New York  
 ALEXIS V MOSCHOWITZ MD New York Empyema with Particular Reference to Its Pathogenesis  
 and Treatment  
 Discussion JOHN L YATES MD Milwaukee JAMES F MITCHELL MD Washington

*Wednesday October 22*

SIR ROBERT JONES F R C S Liverpool Enlarged Stiff and Flail Joints  
 Discussion JOSEPH A BLAKE MD New York JOHN L PORTER MD Chicago JOEL E GOLD  
 THWAIT MD Boston  
 GEORGE W CRILE MD Cleveland Surgical Treatment of Exophthalmic Goiter  
 Discussion J CHALMER D'ACOSTA MD Philadelphia DEAN LEWIS MD Chicago CHARLES  
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 Discussion JOHN J MOORHEAD MD New York WILLIAM O NEILL SHERMAN MD Pittsburgh  
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 York GEORGE EASTMAN Eastman Kodak Company Rochester N Y

*Thursday October 23*

JOHN B DEAYER MD Philadelphia The Acute Abdomen  
 Discussion J M T FINNEY MD Baltimore GEORGE E BREWER MD New York GEORGE  
 L ARMSTRONG MD Montreal  
 MAJOR GILLIES R A M C Sidcup England Plastic Operations for Facial Burns  
 C JEFF MILLER MD New Orleans Radio Therapeutic and Other Methods for Treatment of Cancer  
 of the Uterus  
 Discussion JAMES F PERCY MD Galesburg Ill Caustery HENRY K PANCOAST MD Phila  
 delphia X Ray HAROLD C BAILEY MD New York Radium

*Friday October 24*

Convocation of the American College of Surgeons  
 Confer nce of Honorary Fellowships  
 Presentation of Candidates for Fellowship  
 Presidential Address WILLIAM J MAYO MD Rochester Minn  
 Fellowship Address SIR ANTHONY BOWLBY K C B K C M G K C V O F R C S London

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## SNAPPING HIP

By LEO MAYER, M.D., NEW YORK

THE condition known as snapping hip had been merely a medical term to me until within several months four cases came under my observation. As their study brought out several clinical features which the literature on the subject has not as yet presented I feel justified in reporting them. They seem to me of peculiar interest since taken as a group they help clarify (1) the pathology of the condition, (2) the successful nonoperative treatment of the condition and (3) a successful mode of operation.

I shall describe the cases in the order in which they came under my observation so that the reader may follow my original line of thought. After these casuistical data have been discussed in conjunction with a summary of the literature it will, I think, be possible to gain a clear conception of the pathology of snapping hip and of the principles underlying its treatment.

CASE 1. H. R., male, age 20. The patient, a muscular, well-developed young man, reports that for 4 or 5 years he has been aware of a snapping noise produced by the right hip. He is able to produce this peculiar snap at will by bending slightly at the hip and turning his leg outward. He can prevent the snap when bending and rotating by a slight abduction. Examination showed that the snap occurred when the thigh produced an angle of 150° with the body. The sound was so loud that it could be heard at a distance of 20 to 30 feet. It gave the effect of a distinct dislocation. After the patient had gone through the

maneuver to elicit the snap several times he complained of some soreness otherwise he was free from pain.

My examination was made with the special view of determining whether there was any change in the relations of head and acetabulum before and after the snap occurred. I had expected, owing to the loudness of the report and the impression it gave of a dislocation, to find some change in the bony configuration, but to my surprise both the femur and its socket appeared absolutely normal and there was not the slightest change in their relative positions before and after the snap.

A closer analysis of the phenomenon then showed that as the patient produced the snap there was a sudden passage of a strong fascial band forward and of the great trochanter backward. Immediately preceding the snap the band could be felt posterior to the trochanter upon which it seemed to impinge. Then as the patient bent a little further the band seemed released from the bony projection which held it in check and it slipped forward much as a bowstring snaps as the archer's hand lets the arrow fly.

Before consulting the literature I deemed it advisable to work out for myself some mode of controlling the snap. I tried various manipulations and soon discovered that firm pressure just posterior to the trochanter produced a marked diminution in the shock and frequently entirely prevented the snap from recurring. To maintain this pressure I applied firm adhesive plaster strapping with a large felt pad placed back of the trochanter. The adhesive straps were passed in the same direction as the fibers of the gluteus maximus muscle. With this simple bandage the patient was able to walk about with little or no inconvenience.

CASE 2. The second case was similar to the first except that the snap was not nearly as loud. The patient had noted some trouble for 2 or 3 years but it had not bothered him until 2 or 3

months ago then he began to feel marked so eness owing to the constant snapping of the right hip. He also examination gave evidence of the snapping of a strong band forward over the trochanter. The X-ray taken both in standing and in lying before and after the snap showed normal relationship but with the femoral head and the acetabulum. Figure 1 illustrates the patient's method of producing the snap voluntarily. If standing on the right leg the pelvis sinks toward the opposite side in other words adduct the right leg slightly and then flex slightly at the hip. The alth plaster strapping again involved but as the patient had some permanent loss of application of a pelvic cradle was designed to apply the pressure back of the trochanter. Figure 2 and 3 illustrate the apparatus used. A plaster band could be firmly backed of the trochanter should replace the usual the molded plaster cradle. A strong pressure strap as found in the plaster to hold the trochanter piece in the proper position. Four months later the patient reported that the apparatus had completely prevented the snapping from occurring and that except for the slight inconvenience of wearing it he had no complaint.

CASE 3: The snapping in this case developed through my own fault and directly from my own observation. The patient a wild boyed man of 24 came to me because of an elbow stiffened by a gun shot injury. In the course of the arthroplasty operation I removed a strip of fascia and left it on the upper portion of the left thigh. It was over the newly formed acetabular surface of the humerus. The strip measured about 4 inches and 1 1/2 inches in width. The fascia lata. The elbow operation resulted in good range of motion. The patient came up a day about for a week when he complained to me of a peculiar sensation on the left hip. He said he felt something snap through his hip. Careful examination showed that a snap occurred and that as in the previous cases this seemed due to the sudden pressure of a band over the trochanter. A firm adhesive plaster strapping was applied in such a way as to reinforce the gap in the fascia lata and the snap likewise disappeared. After a few days when the strapping was removed the snap again occurred but after the patient had worn the strapping continuously for 2 or 3 weeks the snap disappeared entirely.

CASE 4: In this the final case of the series the patient a girl of 4 had noted the snapping for about a year. It caused her no pain whatever but annoyed her exceedingly and made her self-conscious. The snap was not loud nor constant. It occurred so far as I could judge about once in every 10 steps. The X-ray again showed normal relationship.

In this case also the adhesive plaster strapping proved entirely adequate in preventing the snap but as the patient was anxious to be rid of all appliances and as an operative correction seemed to me possible she consented to operation. Figure 4

illustrates the incision. This was made just back of the trochanter in the line of the fibers of the gluteus maximus. The fascia lata was divided obliquely in the line of the fibers of the gluteus maximus. No peculiar thickening of the fascia could be noted nor was it possible under anesthesia to elicit the snap. The fibers of the gluteus maximus were separated bluntly until the great trochanter was exposed. The bone seemed to be more prominent and somewhat more irregular than the normal. The margins of the divided fasciae were then sewed to the trochanter. The upper margin above the lower margin. Leaving a gap of about one half inch between the two fascial edges (Fig. 5). A plaster of Paris spica was applied and kept on for 4 weeks. The patient was allowed out of bed after the third week. For a week or so after removing the plaster she complained of slight stiffness but within 6 weeks after the operation the hip was normal. She never experienced a snap after the operation nor did it occur during the year in which she was under my observation.

#### ANATOMY

All four cases were associated with some abnormality of the fascia lata which caused it to catch back of the great trochanter. Other cases of snapping hip have been described in which the snap was supposedly due to an irregularity of the acetabulum which allowed a subluxation to take place. Cases of this type are exceedingly rare and in very few has convincing evidence of the pathological lesion been presented. As I have had no chance to observe cases of this type I shall confine discussion entirely to those instances of snapping hip caused by the fascial anomaly. Zur Verth was the first to call attention to a normal thickening of the fascia lata running longitudinally from the iliac crest downward just in the line of the posterior margin of the great trochanter (Fig. 6). This thickening can readily be demonstrated by making a longitudinal slit in the fascia at the level of the trochanter and passing the finger backward underneath the fascia. A ridge is then palpable on the deep surface of the fascia. If the leg be adducted the fascia and thus band are rendered more tense and press firmly against the bone conversely during abduction the fascia is relaxed. To this thickening Zur Verth applied the term *tractus cristo femoralis*.



Fig 1

Fig 2

Fig 3

Fig 4

Fig 1. Photograph of Case 2 illustrating the posture assumed by the patient when voluntarily causing the hip to snap.

Figs 2 and 3. Photographs of Case 2 illustrating the pelvic girdle and pressure pad used to prevent the snap from occurring.

Fig 4. Photograph of Case 4 illustrating the operative incision. The horizontal line indicates the level of the tip of the trochanter.

#### PHYSIOLOGY

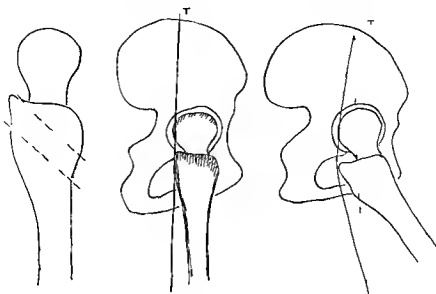
The mode of production of the snap is as follows. With the body weight resting on the pathological hip the pelvis sinks toward the opposite side (Fig 1). In other words an adduction of the pathological thigh takes place. This causes the tractus cristo femoralis to press firmly against the bone and to catch just back of the posterior border of the great trochanter. As the thigh is now flexed on the body, the trochanter passes backward as illustrated in Figure 7 carrying with it the fascial band which thus is rendered more taut in exactly the same way as a bow string is tightened by the pull of the archer's hand. When a certain degree of flexion is reached the trochanter no longer can prevent the tightened fascial band from slipping forward. This it does with a snap (Fig 7). An essential in this mechanism is complete relaxation of the gluteus maximus muscle since if this is contracted the fascial

band is pulled away from the trochanter and is not caught by it.

#### PATHOLOGY

The anatomical and physiological data enable us to understand the pathological lesion which gives rise to the snap. Any condition which causes an abnormal thickening of the tractus cristo femoralis or unusual prominence of the trochanter or an abnormal relaxation of the gluteus maximus muscle may be the responsible factor. In Case 3 in which the snap developed subsequent to the removal of a strip of the fascia lata into which the fibers of the gluteus maximus muscle normally insert it was unquestionably the relaxation of this muscle which caused the phenomenon. In Case 4 it was probably the slight prominence of the trochanter which is to be regarded as the essential lesion. A distinct pathological lesion is however unnecessary since with





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Fg 6

F

Fg 5 D m l l t t b v t h d t t d l t l  
w h h h t f l t w t d t t h g t  
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practice almost any one can learn to produce the snap by following the procedure outlined in the preceding paragraph

#### NONOPERATIVE TREATMENT

The principle underlying the treatment is preventing the fascia from catching back of the trochanter. In case the snap is due to relaxation of the gluteus maximus the difficulty can be corrected by any measure which will overcome this relaxation such as adhesive plaster strapping or a firm flannel spica. Firm pressure back of the trochanter will prevent the adduction which is the initial step in the production of the snap. This pressure can be exerted either by adhesive plaster and felt or by means of a mechanical contrivance as illustrated in the second case (Figs. 2 and 3)

#### OPERATIVE TREATMENT

The simplest mode of preventing the snap is the division of the tractus cri to femoralis and suturing it in such a way as to prevent

I f f b h h a m d m y h s e r v a f w d g o h  
w d m l r e l i n g d f h l m b  
b o e g u h u t h a n k l

it from forming again. This is the basis of the operations devised by Bayer von Brunn and Hohmann. In the case I operated upon the fascia was divided below the level of the trochanter in an oblique line and the two edges of the incised fascia were sutured to the bone with a gap of one half inch between them so as to prevent them from reuniting.

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## PENETRATING CHEST WOUNDS

## REPORT OF 76 CASES TREATED IN A BASE HOSPITAL IN FRANCE

By JOSEPH J LEBOWITZ M.D. AND WALTER H. NADLER M.D. CHICAGO

THE following report based upon the study of 276 penetrating wounds of the chest admitted during a period of 12 months to a base hospital in France about fifty miles from the front is concerned with the cure of patients during an intermediate stage from the time of admission from Casualty Clearing Stations to the time of evacuation to England. Observation of the average case was thus confined to a period extending from the sixth to the thirtieth day after injury.

At the clearing stations where chest injuries comprised about 2 per cent of the wounds admitted resuscitation transfusion and any urgent procedures indicated were employed. Cases which presented indications for primary surgery were operated upon. Closure of sucking wounds removal of foreign bodies particularly large foreign bodies repair of diaphragm excision and repair of lung tissue evacuation of blood from the

pleural cavity and closure of the chest wall by layers were among the operations performed. These patients were held if possible at least 8 to 10 days or until they were in condition to travel to the base by ambulance train. When the number of admissions was very large chest cases did not receive the usual attention and could not always be retained as long as was desirable.

The patients of our series were admitted to the base hospital on an average of 6 days after injury although some arrived on the day of injury and one as long as 46 days after being wounded. At least one clearing station attempted to retain these patients until they were fully convalescent. Even with these precautions many patients arrived at the base in poor condition which rapidly improved after 4 to 48 hours of rest.

At the base patients were admitted to a ward reserved for their cure where they received special attention in regard to comfort

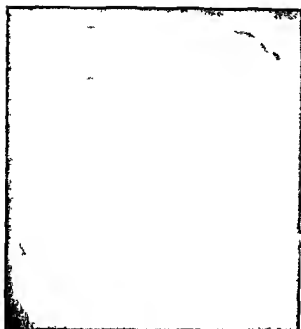


Fig. 1. Axilla. Hematoma. Throat. Df. g.



Fig. 2. Left arm. Throat. Df. g.

and diet. Many were very dyspnoic and cyanotic and required full doses of morphine for the relief of pain and restlessness. Dressings were changed as soon as possible. Patient with evidence of chest penetration even without evidence of hemo or pneumothorax were kept in bed. Cases were retained at least 30 days or until they were in condition to travel to England on stretchers.

Of the 76 penetrating wounds 175 or 63 per cent were simple hemothorax cases of which 27 (15 per cent of this group) became infected. 71 or 26 per cent were pneumothorax or hemopneumothorax cases of which 33 (3 per cent of this group) became infected. The remaining 30 presented other variable symptoms and signs of penetration.

#### TYPES OF CASES 2 6

- 1 Simple hemothorax 75
  - a Remained sterile 148
  - b Became infected 2
- Pneumo and hemopneumothorax 1 (open 26 closed 43)
  - a Remained sterile 48
  - b Became infected 3
- 3 Miscellaneous cases 30
 

Without evidence of hemo or pneumothorax

Small often inconspicuous wound distant from the chest were occasionally found to have penetrated it as in the case of wounds of the axilla arm or face in which the bullet followed a peculiar course due to the position of the patient at the time of injury. Hemo or pneumothorax was found in every instance on the side opposite the wound of entry the bullet either having failed to penetrate the side of entry or having passed through it without producing a demonstrable lesion.

The clinical findings suggestive of injury were not infrequently present on both sides in the case of unilateral wounds. Double hemothorax occurred rarely. The findings of the uninjured side were more commonly due to contralateral collapse or pneumonia.

Wound of the chest wall alone were capable of causing hemoptysis lung infiltration pleurisy empyema and bronchopneumonia. Such cases were not included in the series.

The mortality of the 76 cases was 13 or 54 per cent. Four of the died as a result of associated spinal wounds of which 3 developed local meningitis. One patient with empyema and sepsis was admitted in a moribund condition. It showed at necropsy a pocketed em



FIG. 3. Hæmopn um thora of ri l tche t



Fig. 4. La ge ri ght hæmopneumotho x with retained foreign bo dy

pyema not previously located. 1 died of a pocketed empyema on the side opposite the wound of entry. 1 died of lung abscess and sepsis. 1 of pneumonia on the opposite side.

1 of empyema and pericarditis. 1 of associated suppurative hepatitis. 1 case with gas bacillus infection of the pleural cavity died 60 hours after rib resection. 1 patient died of hemorrhage. 1 suddenly the other after thoracotomy as a result of repeated hemorrhages from an intercostal artery. Postmortem examinations were made in 10 cases.

#### HÆMOTHORAX

Hæmorthorax occurred in 175 cases (63 per cent of the series). It is the most common event in chest wounds. Once the diagnosis of hæmorthorax has been made the early detection of an infected hæmorthorax is the most important consideration because by early drainage extensive pleural exudate organization with permanent loss of lung expansion can be prevented (1). Of our cases 148 remained sterile. 7 (13 per cent) became infected.

Every patient in whom the physical findings indicated the presence of fluid was aspirated as soon as possible after admission. All fluids were cultured. Sterile cases with small

hæmorthorax required no special treatment but where there was much fluid repeated aspirations were sometimes necessary.

Infection occurred early from material carried into the wound or late in the second or third week in cases which had seemed to be sterile probably from the dissemination through the bloody fluid of previously localized infective agents. Apparently all cases are potentially infected.

The diagnosis of infection was often difficult. Practically all patients with penetrating chest wounds showed moderate pyrexia. Late infection was often manifested suddenly by rise in fever, pain and dyspnea or more gradually by continued high fever and jaundice. Repeated aspirations at various levels were resorted to. It was necessary to bear in mind that pyrexia and other signs of sepsis might be due to external wound infection, external gravitation abscess, osteomyelitis of rib or scapula, retained intrapulmonary foreign body or to a coincident trench fever or pneumonia.

Cultures of the 7 infected cases of hæmorthorax and of 12 cases of hæmopneumothorax showed streptococci in 5, staphylo-



Fig 5 L g l ft hxm th f t l th d l  
b d v



Fig 6 L g l ft hxm th f t l th d l  
f th b t d f g l d

cocci in 5 streptococci and staphylococci in 5 pneumococci in 4 pneumococci and staphylococci in 4 anaerobic bacilli in 2 streptococci and anaerobic bacilli in diphtheroid bacilli in 5 and gas bacilli in 6 cases.

The sterile aspirated fluid consisted chiefly of debrinated blood with the addition of a variable amount of exudate. Infected fluid contained more exudate with a variable amount of pus cells.

The physical findings were of interest especially the high level of the diaphragm and the fixation and retraction of the wounded side even with the presence of very small amounts of fluid as well as the frequent presence upon auscultation of distinct breath sounds tubular breathing and increased vocal fremitus over the dull area in patients from whom large amounts of bloody fluid were later aspirated. In these cases sternal resonance was very pronounced. These findings differed markedly from those commonly seen in ordinary pleural effusion. They were ascribed to a condition of lung collapse which Bradford (1) considers one of the leading if not the leading phenomenon of gunshot injuries of the chest. Such collapse usually of the lower lobe suggested by

X-ray examinations has been verified at operation and at necropsy. Collapse has also been described in wounds of the chest wall unassociated with hemothorax and even in certain severe pelvic injuries as well as contralaterally in chest wounds.

One of our patients apparently developed complete collapse of the upper lobe on the injured side. Contralateral collapse of a lower lobe was diagnosed in 20 cases. All of these cleared up. One case developing in the ward was at first mistaken for secondary hemorrhage because of extreme dyspnea and collapse. The physical findings in all these cases suggested pneumonia but there were no other points of resemblance. In typical cases the apex of the heart was drawn toward the collapsed side. As dullness and bronchial breathing decreased rales and finally normal breath sounds were heard.

#### PNEUMOTHORAX

Pneumothorax occurred 71 times. 6 open and 45 closed. Of the open cases 13 remained sterile and 13 became infected. Twenty one cases of open pneumothorax had been closed early before gross signs of infection were present.

ent Of these 9 (43 per cent) remained sterile and 1 became infected (1 of these had been closed at the base) The operation had varied from simple closure of a sucking wound to extensive visceral operations with or without removal of foreign bodies All except small sucking wounds had been closed completely in layers

Thirty three of the 45 closed pneumothorax cases remained sterile while 12 became infected This group included hemothorax The diagnosis of pneumothorax was made in the presence of subcutaneous emphysema associated with hyperresonance and suggestive X ray findings

#### FOREIGN BODIES

Most cases with suspected foreign body were radiographed The majority of wounds particularly those with retained foreign body were caused by shell fragments or shrapnel while apparently most of the entry and exit wounds were made by bullets Extensive wounds with the exception of exit wounds over the scapula were caused for the most part by shell fragments

There were 106 cases of entrance and exit wounds of which 91 remained sterile and 15 (16 per cent) became infected Foreign bodies had been present in the thorax in 132 cases The presence of a foreign body favors the development of infection Fever in 41 cases of retained foreign body in which no intrapleural infection could be detected was probably due to small foci of infection about the foreign body Except in 2 cases where the foreign body was found in the pleural cavity and diaphragm after thoracotomy no attempt was made at the base hospital to remove intrathoracic foreign bodies

#### SPECIAL SYMPTOMS AND COMPLICATIONS

*Shock* was mentioned in the early notes in 21 cases probably only when severe It was frequently noted in patients upon arrival at the base *Hemoptysis* was noted in 95 cases usually as slight *Subcutaneous (surgical) emphysema* was mentioned 61 times It varied from small areas about the wound of entrance or exit to an involvement of the entire trunk It sometimes subsided to recur

later Occasionally subcutaneous emphysema associated with one or more wounds of the chest was the only sign of lung penetration

*Serous effusion* developed nine times on the side opposite as well as on the injured side It was successfully treated by aspiration *Lung abscess* occurred in four cases three of which recovered sufficiently to be sent to England One died One case of metastatic empyema also occurred *Secondary hemorrhage* was very rare 3 cases were seen *Pericarditis* complicated 4 cases twice with the development of effusion One died

*Intrathoracic and intra abdominal wounds* were associated in 10 cases There were 6 chest wounds with associated spinal injury

#### SURGICAL PROCEDURES

The surgical treatment of penetrating chest wounds at the base was confined in general to the treatment of complications chiefly of infection and particularly of infected hemothorax as well as to procedures that had been omitted or unfinished at the Casualty Clearing Station

Practically all except small clean entrance and exit wounds had required some operative procedure at the Casualty Clearing Station or required it later at the base hospital Removal of foreign body from the chest wall excision and cleaning of wound and exploration for bone injury were usually performed in the forward area Primary intrathoracic operations with complete closure gave promise of success only when performed on freshly wounded cases at the Casualty Clearing Station

At the base hospital all cases of hemothorax in which bacteriological examination showed the presence of organisms even though the patient presented no other signs of infection were promptly treated by rib resection Where cultures remained sterile after repeated aspirations at various levels operation was not performed even though the patients appeared septic Thoracotomy was performed in 32 cases 31 times for the relief of intrapleural infection and once in a sucking wound In 23 cases this was the first surgical exposure of the pleura in 7 the operation was done for drainage of the pleural cavity follow

ing closure by layers at the Casualty Clearing Station and in 3 cases to provide further drainage to chests in which resection had been done at the Casualty Clearing Station.

Three cases were operated upon under local the remainder under ether anaesthesia. The most dependent portion of chest was chosen as the site for rib resection bearing in mind the frequent high level of the diaphragm. It was usually possible to select the eighth or ninth rib. Clots were evacuated from the pleural cavity. In 11 cases after irrigating the pleural cavity with eusol Carrel Dakin tubes and a large drainage tube were inserted and eusol instilled every two hours. The results were very good.

Primary closure was done in 4 cases. One later required drainage the other died 4 hours after operation from an associated spinal injury.

#### CONCLUSIONS

1. The mortality of penetrating chest wounds that reached the base was low (5.4 per cent) due chiefly to sepsis, pocketed empyema and associated injuries.

2. These patients require treatment in special wards. Co-operation of internist, pathologist, roentgenologist and surgeon is essential.

3. Hæmothorax is the commonest event in chest wounds. Early diagnosis of infection is the most important duty at the base.

4. Thoracotomy for infected hæmothorax is the most frequent surgical procedure at the base hospital. Carrel Dakin treatment for empyema gives good results.

5. Primary intrathoracic operations with closure may be performed early after injury—in the British Expeditionary Forces at the Casualty Clearing Station—in properly selected cases with no more danger than abdominal operations. Of 21 cases operated upon and closed 9 remained sterile. It would seem that this type of case in particular should be retained for a longer period than was customary to insure safety and comfort in travel.

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## GUNSHOT INJURIES OF THE LUNG AND CHEST

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IT is known that gunshot injuries of the chest in war show a decreasing mortality the farther from the firing line they are observed. Duval states that at the first dressing stations the mortality is 5 to 30 per cent where the deaths usually result from hemorrhage or large defects in the chest wall with sucking wounds. The cases treated in the automobile surgical ambulances of the French had a mortality of about 20 per cent and in the stationary hospital farther to the rear an average mortality of 10 to 12 per cent was observed. This brings the total mortality to nearly 50 per cent and does not include deaths from late complications.

In presenting a group of cases observed in the base hospital it is understood that the greatest loss by death has already occurred in the forward stations and that the chief benefit to be derived from the study of cases at the rear is in conjunction with the complications and their treatment and the probable functional results occurring in certain types of injury. As to the advisability of attempting to outline indications for operation at the front from observations made at the rear there is considerable doubt for every injury to the chest presents a rather acute problem in itself which is best appreciated by the men working at the front and which cannot be entirely sensed a week to a month later when the patient enters a base hospital.

Certain well defined principles of treatment have been outlined and generally accepted for the early management of these cases. DePage has pointed out the fact that 60 per cent of the total mortality occurs in the first 5 days so early treatment is indicated especially where operative work is necessary. The policy of early debridement of wounds and closure of all sucking wounds of the chest is accepted by all. Less clear indications are advanced for the removal of foreign bodies and the control of acute hemorrhage. Some surgeons are much more enthusiastic than others in advocating the early removal of

foreign bodies from the lung. It is well recognized that machine gun bullet wounds of the lung are less serious than those due to high explosive fragments and that machine gun bullets are retained in the lung with less prospect of subsequent trouble developing. Duval believes that as in other wounds relatively large fragments of high explosive shell should be removed from the lung at the earliest possible moment and that cases with urgent hemorrhage into the pleura or externally through a sucking wound should be operated upon and the lung sutured.

Of the 78 cases of gunshot wounds of the chest coming to Base Hospital 13 patients had retained machine gun bullets in the lung and 18 had retained fragments of high explosive in the chest and of these it became necessary to remove 5 at the base because of complications which followed their presence. In contradistinction to this only one case having had an operative removal of a foreign body from the lung or pleura reached our hospital. This may mean that few were operated upon on the American front or that the mortality was high.

In reviewing these cases a division between machine gun bullet and high explosive wounds will be made. Perforating wounds of the chest and retained foreign bodies in the chest will first be considered and then a brief statement concerning sucking wounds of the chest, hemothorax and empyema will follow. The patients in this group arrived at the base anywhere from a few days to two months after their injury but the majority came under observation on an average of a week after their injury.

## PERFORATING WOUNDS OF THE CHEST

a *From machine gun bullets.* The 29 patients with perforating wounds of the lungs or pleura were relatively out of danger when they arrived at the base. From injury to the lung itself there were few complications and pneumonia developed in only two cases.





one to believe that most of these men were injured in the upright position or else that practically all of those with penetration of the abdomen never got back to the base.

About two thirds of these cases had been operated on at the front either in a field or evacuation hospital within 1 or 2 days after injury the operations consisting in closure of the sucking wounds and debridement of wounds of entrance and exit. In no instance was a major thoracotomy performed or repair of a lung perforation or removal of blood from the pleural cavity attempted.

Practically every case in this group developed some complication after leaving the front. A few had only a simple hemothorax which was in some instances extensive enough to produce complete lung collapse and displacement of the mediastinum with serious embarrassment of respiration. Empyema occurred in 65 per cent and only one of these followed pneumonia. Secondary hemorrhage from the lung was seen in but a single case which had been complicated by perforation of the diaphragm and formation of a biliary fistula between the lung and the liver. Pneumothorax though noted in slight degree along with simple hemothorax was only once extensive enough to cause complete atelectasis and displacement of the mediastinal contents.

Secondary surgical interference was necessary in all but one of the complicated cases the operations consisting in aspiration of those with hemothorax or pneumothorax drainage of the empyemas by rib resection or re-opening of a sucking wound and repeated blood transfusions in the case of secondary pulmonary hemorrhage.

The end results as the patients left our hospital were quite satisfactory. The final notations were made on the average at the eightieth day. At that time about 20 per cent had been doing full duty about the wards and the majority were ambulatory and in good condition. 60 per cent of the empyemas had a draining sinus still present. Practically three fourths showed evidence of some degree of thickening of the pleura from either a hemothorax or infected pleura. Approximately a half had noticeable immobility and retrac-

tion of the chest wall but only a small percentage complained of dyspnea cough or pain in the chest. The mortality of 5 per cent was due to the one case of secondary pulmonary hemorrhage.

#### PERFORATING WOUNDS FROM HIGH EXPLOSIVE

| FRAGMENTS                               |    |
|---|----|
| Complicated by sucking wounds           | 7  |
| Complicated by fractured ribs           | 6  |
| Complicated by primary hemothorax       | 3  |
| Complicated by perforation of diaphragm | 1  |
| Total                                   | 17 |

| Operations at the Front  |    |
|--------------------------|----|
| Closure of sucking wound | 5  |
| Débridement              | 7  |
| Total                    | 12 |

| Complications at Base |    |
|-----------------------|----|
| Hæmopneumothorax      | 6  |
| Empyema               | 6  |
| Pneumonia             | 1  |
| 2d hæmorrhage         | 1  |
| Total                 | 18 |

| End Results on an Average of 80 Days after Injury |    |
|---|----|
| Duty  | 3  |
| Ambulatory  | 13 |
| Sinus   | 6  |
| Thick pleura                                      | 11 |
| Immobilty of chest                                | 1  |
| Dyspnea cough or pain                             | 3  |
| Death   | 1  |

#### Summary

1. One half to two thirds of the perforating wounds of the chest regardless of the type of missile were complicated by a hemothorax.

2. Sucking wounds of the chest wall were present in 41 per cent of the perforating wounds of the chest from high explosive and in only 7 per cent from machine gun bullets.

3. Fifty nine (59) per cent of the perforating wounds from high explosives developed an empyema in contrast to 15 per cent from machine gun bullets. The frequency of empyema after sucking wound is an important factor in this connection.

4. Pneumonia followed perforating wounds of the chest in only 6 per cent of the cases.

5. There was a mortality of two patients or slightly over 4 per cent at the base in perforating wounds of the chest.

# RETAINED FOREIGN BODIES IN LUNG OR PLEURA

*a Machine gun bullets* Of the 11 patients reaching us with retained machine gun bullets in the lung or pleura none had been operated upon at the front for removal of foreign body. Though practically all had a hæmothorax on the injured side only two had been aspirated at the front and on entrance at the hospital embarrassment of respiration and moderate interference with heart action was noted in most of the patients. Bizarre symptoms were occasionally present as in an officer who was unable to breathe without great effort upon bending his head forward toward his chest though in normal posture he had no difficulty in breathing. As was the usual practice every hæmothorax was aspirated. If a very large amount of blood was present it was removed at several sittings several days apart. We were of the opinion that none of these chests refilled after complete aspiration. Only one of these patients developed a pneumonia and none was complicated by a lung abscess.

As accurately as one could judge from physical signs and repeated stereoscopic X-ray plates the missiles were well tolerated in the lung and after the initial reaction due to trauma there was no evidence of fibrosis or cavity formation around them. In one case studied with repeated stereoscopic plates it seemed certain that the position of the bullet had changed and that it was lying at a lower level in the lung. In another case illustrating the tolerance with which bullets were borne a boy who had been wounded in the arm by a machine gun bullet never knew (and it apparently had escaped notice at the front) that the bullet had penetrated the lung and mediastinum and was lodged in the lung on the opposite side. A moderate sized hæmothorax called attention to the retained foreign body.

Empyema developed in one third of the cases which is in contrast to perforating wounds of the chest from machine gun bullets where only one seventh developed empyema. Two of the cases had machine gun bullets lying free in the pleural cavity and were removed when the empyema was drained.

There was apparently no connection between the empyema and the retained foreign body in the other cases.

On an average of 68 days after injury these patients were last examined. Moderate thickening of the pleura over recent hæmothorax and small sinuses with thickened pleura in the empyema cases were present. In general the well being of the patients was excellent and they were showing progressive improvement.

| Operat ns Perform d at the F o t                         |    |
|--|----|
| Débr d ment sup ricial w u ds                            | 1  |
| Asp tion hæmotho   | 2  |
| C mpl cati ns of the I j ry                              |    |
| Hæm thora  | 9  |
| F t ed b   | 4  |
| S cking wou ds   | 1  |
| S bseq t Compl t s                                       |    |
| Empyema  | 4  |
| Pneum  |    |
| T tment at B se  |    |
| A p rat on f hæm th ra                                   | 3  |
| Dra nag f empy m   | 4  |
| F reig b dies m ed f omple ra                            |    |
| Exam at on of Pat ts on an Aver e of 68 D ys fter I j ry |    |
| W lk g d ty  | 11 |
| M de t thuck g f pl r ft                                 |    |
| hæm th a   | 5  |
| S nuse ft t empy m                                       | 4  |
| P i h st   | 3  |
| D ath  |    |

*b High explosive fragments* Approximately one half of the wounds caused by high explosives had fragments of the missile retained within the chest the majority of which were in the lung itself and a few either in the pleural cavity or the mediastinum. The complications of the primary injury were of the same nature as with the through and through wounds the percentage of sucking wounds fractured ribs and hæmothorax being about equal in the two groups.

Exactly two thirds of these 18 cases had been operated on at the front all within 48 hours after injury except 3 cases which arrived after the second day. The operations consisted in debridement of the superficial wounds closure of the sucking wounds and aspiration to relieve hæmothorax. In only two instances was thoracotomy done one of

which was a successful removal of a foreign body from the pleura

After leaving the front secondary complications arose in two thirds of the cases of which over one half were empyemas a third pneumonias and the remainder simple hæmothorax lung abscess gangrene of the lung or mediastinitis. It is interesting to note that 3 of the 7 empyemas followed pneumonia.

All of these complicated cases required further surgical treatment. Aspiration often repeated relieved those with hæmothorax or pneumothorax rib resection was done in cases of the empyema and lung abscess and transfusion of blood at times was necessary. In over one fourth of the cases foreign bodies were removed from the chest either by a thoracotomy or through a persistent sinus. In one of these 5 cases the shell fragment lay in the mediastinum just to the left of the arch of the aorta.

As an average the end result was noted on the seventy third day. One patient died of pneumonia. One half of the total were doing full duty about the hospital. Practically all were ambulatory, had gained markedly in weight and were in excellent general condition. The majority of the empyemas were still draining through a small sinus. Over a half of the total number showed evidence of thickening of the pleura which was in most instances sufficient to produce a noticeable immobility and retraction of the affected sides. Only two complained of pain in the chest and one of dyspnoea or cough. Practically two thirds of this group left the hospital with foreign bodies still present in the chest without material evidence of lung pathology.

#### RETAINED HIGH EXPLOSIVE FRAGMENTS

|   |    |
|---|----|
| Total cases                             | 18 |
| Complicated sucking wounds              | 4  |
| Complicated by fractured ribs           | 8  |
| Complicated by hæmothorax               | 5  |
| Complicated by tissue empyema           | 1  |
| Complicated by perforation of diaphragm | 1  |
| Cases operated upon at the front        | 12 |
| Aspiration                              | 2  |
| Closure of sucking wound                | 4  |
| Attempted removal of foreign body       | 2  |
| Débridement                             | 9  |

|                   |   |
|-------------------|---|
| Complicated cases | 1 |
| Hæmopneumothorax  | 3 |
| Pneumonia         | 4 |
| Empyema           | 7 |
| Lung abscess      | 1 |
| Gangrene of lung  | 1 |
| Mediastinitis     | 1 |

#### End Results — Seventy third Day

|                         |    |
|-------------------------|----|
| Duty                    | 9  |
| Ambulatory              | 14 |
| Sinus                   | 5  |
| Thick pleura            | 10 |
| Foreign bodies in chest | 13 |
| Immobility of chest     | 8  |
| Pain, dyspnoea or cough | 2  |
| Death                   | 1  |

#### Summary

1 In 29 cases with foreign bodies retained in the chest only 1 successful attempt at removal was made at the front when a fragment of high explosive was removed from the pleura.

2 At the base it became necessary to remove two machine gun bullets from the pleura because of empyema, one piece of high explosive from the mediastinum because of mediastinitis and four high explosive fragments from the lung or pleura because of severe infection. One death resulted following operation due to bilateral broncho pneumonia.

3 Pneumonia developed in 5 of the 29 cases, all but 1 following wounds from high explosives.

4 Empyema developed in one third of the cases with retained machine gun bullets and in about one half of those with retained high explosive fragments. Sucking wounds were present in about the same proportion in the two types of injury.

5 Twenty two patients left the base hospital with retained foreign bodies in the lung with apparently no impairment of respiratory function.

6 Mortality of 1 case in this group of 29 or 3.5 per cent.

#### SUCKING WOUNDS OF THE CHEST

Sixteen patients had sucking wounds of the chest. Eleven were due to injury from high explosive fragments and 5 from machine gun bullets. All but 3 patients had been operated upon at the front with closure of the

sucking wound. Although 5 had retained foreign bodies in the lung or pleura none had been removed. One patient had had an operative removal of a fragment of high explosive from his liver which had perforated the lung, diaphragm. Nine of the patients had compound fractures of ribs.

The treatment at the base consisted of aspiration of blood from the pleural cavity in the 6 cases with hemothorax and drainage through the original wound or by rib resection in the 10 patients having empyema which developed from 1 to 30 days after injury.

Examined two months after injury these patients with one exception were doing light duty and were in good general condition. All but one of the empyemas had sinuses and all had thickened pleura and more or less immobilization of the chest but were in good general condition.

One of the patients in this group died at the base two months after his injury. A high explosive fragment had caused a sucking wound of the chest had penetrated the diaphragm and liver. The shell fragment had been removed from his liver at the front but a biliary fistula persisted between the liver and the lung. In the course of his convalescence he had a number of pulmonary hemorrhages for which he was transfused with blood. At postmortem a cavity the size of an orange was found between the lung and the visceral pleura containing bile and blood and connecting with the liver by a fistula.

### Summary

1. Seventy per cent of the sucking wounds were due to high explosive fragments.
2. Sixty three per cent of the sucking wounds developed an empyema.
3. Mortality of sucking wounds 6 per cent.
4. The general condition of the patients after two months was good.

### HÆMOTHORAX CASES

In the series of 78 gunshot wounds of the chest 38 had a hemothorax, 13 of which developed an empyema and 3 a pneumonia. It is difficult to say whether the empyemas were due to organisms lodged within the

chest as a result of the primary injury or whether the hemothorax became secondarily infected by extension from some neighboring focus such as osteomyelitis of the ribs. The fact that most of the empyemas developed early and that practically all cases that came to us with a simple hemothorax remained clean would make the former seem more probable.

The 23 remaining cases uncomplicated by infection while under observation in France are here considered separately.

As to the cause of the hemothorax fractured rib were noted in one third of the cases and sucking wounds in about one fourth. The majority of the men had had through and through wounds from machine gun bullets though over one third had retained fragments of high explosive or machine gun bullets in the chest.

Operative treatment at the front had been necessary in only one half of the cases and consisted in debridement of the superficial wounds, closure of sucking wounds or simple aspiration of the blood. In no instance had a thoracotomy been done for removal of foreign bodies or clots from the pleural cavity.

After reaching the base the surgical management was limited entirely to simple aspiration of the retained fluid. Occasionally a patient arrived in poor condition having sufficient hemothorax to cause complete lung collapse, displacement of the mediastinum and the signs of severe embarrassment to respiration. As a rule however the condition was less acute and there was ample time and facility to study the case fluoroscopically and control surgical management by means of the X-ray. The apparatus used at our hospital for aspirations consisted of a good sized bottle fitted with a two way valve, one connected to the aspirating needle and the other leading by a long rubber tube to a water faucet. This attachment was made by a T shaped connecting piece in such a way that by regulating the flow of water from the faucet the degree of suction through the needle could be accurately controlled. We found the apparatus to be useful not only for hemothorax and empyema cases but for blood transfusion work as well.

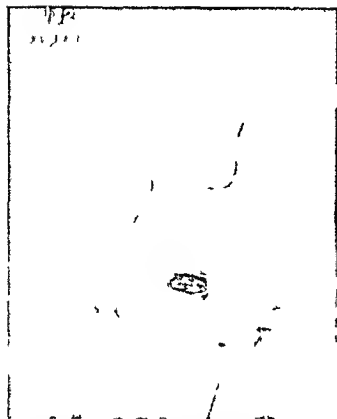


Fig. 1. Pt. Ira B. High explosive wound of chest with retained foreign body in mediastinum complicated by suppurative mediastinitis. Shell fragment removed under fluoroscope from mediastinum. Recovery.

Ordinarily no trouble was encountered in doing these aspirations. With the patient in the sitting or lying position (depending on his condition) a medium sized needle was inserted through a dependant intercostal space (the soft tissue being anesthetized with cocaine) and the thin fluid blood easily drawn off. Infrequently difficulty was met in those cases that had never been previously operated upon and in which the hemothorax had become to a large extent organized. In spite of the use of a very large needle or trocar it was impossible to remove more than a few cubic centimeters of thick clotted blood.

Ample opportunity was furnished because of the delay in transportation of patients to study the end results of the cases after a considerable period of time. On the average the final notations were made on the sixty third day. At that time over one half of the 3 cases had been doing full duty without apparent physical disability and all the

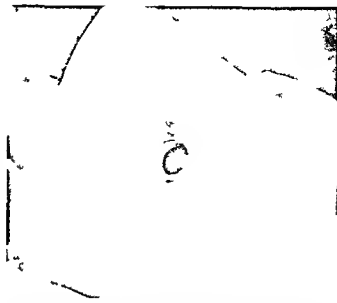


Fig. 2. Pt. Osar V. Sucking wound of chest from high explosive which was closed at the front but developed empyema and a drainage tube inserted through the wound 6 days after injury. Recovery.

#### CLEAN HÆMOTHORAX CASES

| Total cases                      | 23 |
|----------------------------------|----|
| Complications                    |    |
| Complicated by pneumothorax      | 6  |
| Complicated by sucking wound     | 5  |
| Complicated by fractured rib     | 8  |
| Total through and through wounds | 16 |
| Machine gun bullets              | 13 |
| High explosive                   | 3  |
| Total retained                   | 7  |
| Machine gun bullets              | 3  |
| High explosive                   | 4  |
| Cases operated upon at Front     | 11 |
| Debridement                      | 5  |
| Closure of sucking wound         | 3  |
| Aspiration                       | 3  |
| Final Result — Sixty second day  |    |
| Duty                             | 9  |
| Ambulatory                       | 1  |
| Thick pleura                     | 17 |
| Immobilty of chest               | 1  |
| Pain                             | 5  |
| Cough                            |    |
| Dyspnoea                         | 4  |

others were ambulatory except who were confined to bed because of other injuries. Careful examination showed in a majority of the men evidence of thickening of the pleura which in about two thirds of the cases was sufficient to cause noticeable retraction and relative immobility of the affected side. Only a small number com-



minor role in the causation of empyema. Extensive operative procedures on severely wounded men such as suture of the diaphragm were frequently followed by empyema.

In treatment of this class of cases a rib resection was done under local anesthesia and tubular drainage employed in most instances. In the sucking wounds with empyema drainage was usually sufficient through the wound already present. Where cavities were present they were irrigated with Dakin's solution.

The patients were examined last on an average of 3 months after their injury and 75

per cent of them were in good general condition. Nearly all had moderate to marked thickening of the pleura with more or less immobilization of the chest wall. Seventy per cent had sinuses but very few had large cavities. A few complained of pain in the chest, had dyspnea, tachycardia and some cough. These usually were the cases which had had large sucking wounds or whose empyema had been insufficiently drained early in its course. Only one patient had died and his death was due to postoperative bilateral bronchopneumonia following removal of a piece of high explosive from the pleura in which a large empyema had formed.

## RESECTION OF THE LUNG FOR POST-TONSILLECTOMY ABSCESS<sup>1</sup>

By HOWARD LILIENTHAL, M.D., F.A.C.S., NEW YORK.

**T**HE accompanying report of extirpation of the right lower middle and part of the upper lobe with subsequent atrophy leaving no lung in the right chest is thought to be of sufficient interest to warrant presentation.

The patient, Mr. W. A. B., age 26, was first seen by me on March 20, 1917.

About 15 months before he had had his tonsils removed in general anesthesia and about a week afterward coughing began with foul expectoration and occasional hemorrhages. For days and even weeks at a time the patient felt fairly well and coughed but little. Then there would be an attack of fever, hemorrhage, emptying of the abscess and much coughing with the discharge of large quantities of fetid pus. His first hemorrhage occurred about 6 weeks after the onset of the symptoms. At that time his general condition was good and his blood showed 4,300,000 red blood cells with 9,500 white cells. Within a few weeks fifteen hemorrhages some quite copious occurred. Occasionally there was an attack of emptying in which as much as a pint of foul pus was coughed up in a few hours.

In the beginning of the illness pneumococcus was found in the sputum and autogenous vaccines were given with no apparent improvement. Indeed there was some hemoptysis after each injection.

A ray on July 1, 1916, resulted in the following findings. In the right chest there was a cavity in the mid-clavicular line, an area of infiltration from

the seventh to ninth ribs (middle lobe) with a cavity about the size of a walnut. Infiltration about 4 inches vertical by 3 inches horizontal. There was much infiltration into the lung tissue outside the zone of inflammatory reaction.

July 2, 1916. Blood count 3,800,000 red blood cells and 10,000 white. The urine showed a few granular casts. A few days before this finding the patient had had a hemorrhage followed by a large quantity of pus which had accumulated for over a fortnight. There was relief for ten days.

On February 28, 1917, the patient's condition had become extremely bad and he decided to be operated upon. He had been confined to his bed since November 1916, more than 3 months. (During all this time I had known the patient through his letters only.)

On March 5, 1917, he wrote stating that his temperatures were running between 100° and 103° and that he was expectorating a little blood each day and a large amount of pus.

On March 14, 1917, he came to New York and entered the Private Patient department of Mt. Sinai Hospital where I first saw him. As a surgical risk he was most unpromising. His temperature was 104°, his pulse rapid, he was emaciated to the last degree, his eyes presented the peculiar glassy expression of approaching death and altogether he looked like a person in the last stages of tuberculosis. Although numerous examinations of sputum had failed to show acid fast bacilli. An additional examination at Mt. Sinai was also negative. Wassermann examination negative. In spite of the length of his illness there was little clubbing of the





Fig. 1. Lateral view of the thoracic incision. The incision is made in the intercostal space, and the chest is opened. The lungs are visible, and the diaphragm is seen. The incision is closed with sutures.



Fig. 2. Anterior view of the thoracic incision. The incision is made in the intercostal space, and the chest is opened. The lungs are visible, and the diaphragm is seen. The incision is closed with sutures.

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e e f s t e d to the d t a n t e d ith a s f e t y  
p l h ch as s p l c e l out s d of the ch s t a  
to anchor the medi stinum h ch e u l l b s en at the  
b t tom of the oun l through norm l pleu a the  
h a r t b e n also plainly visibl A large stuff f  
doform ed gauz as laid ag st th stump On  
f e n g the intrapharyngeal pre sure the pper lobe  
s e n to flate n part The o n d s n v



Fig 3

Fig 3 Tent of wound a few weeks after operation. Patient up and about. With a ret actor in this wound all parts of the chest could be easily observed.



Fig 4

Fig 4 Wound entirely healed at the time patient was exhibited. Note function of the right arm.



Fig 5

Fig 5 View from front. Comparatively little asymmetry.

closed in two layers without drainage the packing and the ligatures with their safety pin being buried beneath the skin so that at the end of the operation the chest was completely sealed. Before the last suture was tied a little more than a pint of paraffine oil was poured into the thoracic cavity and left there. The operation over 500 cubic centimeters of entrapped blood were transfused by A. O. Wilensky and Reuben Ottenberg and the specimen was taken by Wilensky for study and examination.

There was no immediate reaction the patient's pulse in the evening being 120 the respirations 24. He was kept well under morphine in order to slow the breathing for the first part of the postoperative time.

Fifty-six hours afterward the temperature rose to 10.8 the respirations to 34 and the pulse to 144. I then removed some of the sutures at the posterior angle of the wound and inserted a drainage tube evacuating about a quart and a half of extremely foul blood stained fluid. Relief followed.

Three days after the operation I removed the iodoformed gauze. The patient had now improved a little the thermometer registering 101 the pulse rate being 130 the respirations 8 and the cough almost absent. From this time on however for a number of days he had a stormy time. All sutures had to be removed on account of a foul sloughing condition in the wound.

Because of open bronchi the Carrel-Dakin method could not be employed in this case the patient almost strangling at the first attempt although the stump had not yet come away.

The case now showed all the evidence of general gangrenous pleurisy. A catheter was inserted into the thorax and for several days a constant slow stream of oxygen was passed in the hope of combating the anaerobic infection. Respiration rose to 40 and the pulse to 140 in spite of considerable quantities of morphine. At the suggestion of Ware

I now packed the entire thoracic cavity with iodoformed gauze and three days later the surface began to clean off.

The wound opening was enormous so with the aid of a long retractor all parts of the chest could be inspected daily.

Gradually the pungent odor of the anaerobic infection wore off and on March 29 13 days after the operation the stump came away easily and without hemorrhage. It was noted that the remainder of the upper lobe was coated with fibrinous exudate.

On April 6 I resected the right phrenic nerve in the neck in order to paralyze the diaphragm but as the subsequent X-ray study shows this muscle did not rise into the chest but was even flattened by the contraction of the organized exudate. At the same sitting I removed nearly the whole length of the eighth rib both to secure easier access for treatment and to aid in the collapse of the lower part of the chest.

Before the patient was discharged I resected a large part of the ninth and tenth ribs also and following this there was great discomfort with considerable abdominal pain which lasted for nearly two weeks.

The remaining part of the upper pulmonary lobe was apparently not functioning probably because of the total absence of normal intrathoracic differential pressure and also because of the presence of the very large bronchial fistulae.

From this time on the patient gradually improved and the wound slowly contracted. He returned to his work that of hospital secretary on July 16 1917 exactly 4 months after his operation. When clothed his figure looks symmetrical but naturally there is considerable contraction of the right chest. The wound remained open for nearly a year longer then gradually closed but reopened once or twice and finally healed soundly.

February 28 1919 an X-ray examination was



F 6 R nt \ y f m b h d \ r l t l l  
t in ght pe Pl e f b t lung t k by p  
m th

made by Major H wa d F Ashbury MC who reports as follows

There has been a resection of the sixth seventh eighth ninth and tenth ribs on the right with the removal of the greater portion of the seventh eighth ninth and tenth ribs on the right. The chest wall is depressed at this portion and there is some abnormal formation. There is no evidence of lung tissue on the periphery of the resected rib cage. The chest is partially aerated in the field close to the hilus. The left lung is apparently normal. There is some displacement of the heart toward the right. The diaphragm on the right side is much flattened.

The accompanying photograph and X-ray reproduction with the legend are self-explanatory.

After studying the specimen removed at operation in March 1910, Abraham O Wilensky under date of May 15 1910 reports the following:

The specimen which was moved in March 1917 consists of the middle (smaller piece) and lower lobes of the right lung. The upper half of the lower lobe is hard and indurated and contains the abscess cavity which originally had been filled with a thick yellow pus. The open end of the bronchus of the second and third order can be seen opening into the cavity.



F 6 R nt \ y f m b h d \ r l t l l  
t in ght pe Pl e f b t lung t k by p  
m th

Microscopically there are (1) areas of round cell infiltration in which the pulmonary markings are lost (2) areas of thickened septa and dilated vessels (3) areas of alveoli filled with isolated epithelial cells. The bronchi are the seat of a suppurative bronchitis.

The pleural fluid is clear yellow and on standing an albuminous clot separated out. It is bacteriologically negative. The pus contained numerous gram positive and negative organisms. Anaerobic culture was unsuccessful.

Postscript: I had not seen the patient for more than a year and not until he appeared at the meeting. He was in excellent general condition and stated that he was able to dance through sixteen dances without undue effort and without shortness of breath. The clinical pneumothorax shown in the X-ray was a surprise to me.

The physical examination was most interesting and the true condition of affairs could have been difficult to determine without the aid of the X-ray since conduct on of breath and voice sound were quite perfect. The patient was examined by Dr L. W. Bruns and other members of the Society.

## A CONTRIBUTION TO THE SURGICAL PATHOLOGY OF RANULA

BY P. G. SKILLER, JR., M.D., F.A.C.S., PHILADELPHIA

WHEN you hear the term *ranula* you immediately picture in your mind some sort of a cyst in the floor of the mouth beneath the tip of the tongue but have you a clear conception of the source and origin of a cyst in this locality? Or have you a notion more or less hazy that there may be involved the duct of the sublingual or submandibular salivary gland or the incisive gland or the apical gland of Luhn and Blandin? The following case owing to the peculiar circumstances under which it was treated offered an ideal opportunity for the study of the pathogenesis of ranula. The peculiar circumstances of treatment to which I refer are these: One year and three months before I first saw the patient she was operated upon elsewhere and her sublingual and submandibular salivary glands both were removed without however relieving her of her condition for it recurred. That the same lesion I encountered was present at the time the first surgeon operated is proven by reference to the description of that operation in his own words:

Transverse incision below left mandible and parallel with it. Immediately under the deep fascia a cyst with paper thin walls was encountered containing a thick glairy fluid. It seemed to be connected in some way with the submaxillary or sublingual salivary gland but as it was unfortunately opened during the section—the walls collapsing to a cobweb—it was impossible accurately to determine just what it was whether a cystic hygroma or a retention cyst of a small part of the salivary gland. The submaxillary salivary gland as well as the sublingual were dissected out and the wound was closed.

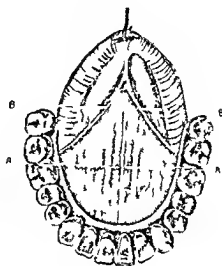
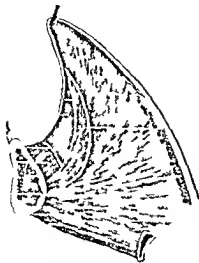
The patient stated that 5 months after that operation the swelling reappeared and was the same as before the operation.

The patient a female aged 28 was referred to me by Dr. Ennon. The previous history I have already given except that the first hospital record did not state how long the patient had had the swelling previous to the first operation. Physical examination revealed in the left submandibular region a swelling that was not tense but soft and

fluctuating which presented many of the characteristic of a cold abscess—namely by the absence of the cardinal sign of inflammation and from the swelling. The skin over the swelling was normal in color, freely movable and free from adhesion and induration, the abundant fat over the center of the swelling was thick and at each point showing no connection between the tumor and the skin and no inclination of the content of the tumor to reach the surface by pointing. On opening the mouth there was a bump beneath the left side of the tongue—an alveoloepithelial ulcer—a cystic swelling that bulged more and more as the submandibular swelling was pressed upon until finally it occupied the entire ulcer from the frenum of the tongue to the second molar tooth. On releasing the submandibular swelling from pressure the sublingual swelling subsided to its former size thus suggesting a direct channel of communication between the sublingual and submandibular swelling. There were no palpably enlarged regional lymph nodes.

Operation was performed under ether and the U and J shaped submandibular incision was made over the swelling on reflecting the skin and superficial fascia there was exposed a large cyst with a thin bluish white wall that bore a striking resemblance to the belly of a frog. The wall of the cyst was as thin as a sheet of bond paper. On opening the cyst there escaped a clear glairy fluid that resembled nothing more closely than the white of a raw egg. The cyst contained about two ounces of the material which was removed. The interior of the cyst could now be examined; its lining was smooth and lustrous and wholly free from trabeculae or other focal thickenings or points of degeneration. The empty cyst cavity could now be oriented; its mesial wall was in relation with the structures that form the floor of the orotid but chiefly the digastric triangle below it extended as far as the thyroid cartilage above and behind as far as the stylo-mandibular ligament which separated it from the parotid salivary gland while above and anteriorly it narrowed down to a channel of the diameter of a lead pencil which led the exploring little finger past the mylohyoid muscle upward to the floor of the mouth in contact with the deep surface of the mucous membrane stretching from the side of the tongue to the alveolar process and from the frenum of the tongue backward to the second molar tooth.

No attempt to excise the cyst wall was made but it was dealt with in the following manner. The orifice of communication through the mylohyoid muscle corresponding to the constriction of an hour glass was tightly closed by a catgut suture thus dividing the cyst wall into two cavities in



l (t ft) Sut l m b r s a ll d fl l m f th<sup>re</sup> a m ter  
p t t t t m of th uth f C t<sup>re</sup> m l ubl g l m c  
t t t t t m ll C t t t m l l D th l t t l  
g l n l C th g l pth f the burs f t t f Wh t F th bl g l  
l d th t r m u b ll f f m th f t ft e ha p n ly  
m l l l l d r s f th b l f f l t r s f l t ft th f g n g l

upper oral and a love cer cal The lo ce  
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Now Tillman<sup>1</sup> raises the question as to whether or not ranula is the result of hydrops of the sublingual bursa having no other connection with the salivary glands than that of neighborhood and add It is that which remains to be found out I feel that my case answers quite accurately this last statement for the swelling was proven to be wholly independent of the neighboring salivary glands for the latter were removed at the first operation As to the swelling in my case being attributable to hydrops of the sublingual bursa a possibility which Sir James Paget in his *Lectures on Surgical Pathology* also mentions let us recall just what the sublingual bursa to which Tillman refers is and just where it is I have often noticed in examining the mouth how when the patient curls back the tip of

the tongue the lax mucous lining the sublingual pouch slides freely back and forth over the underlying structures here then is a friction etc and is elsewhere in the body where friction occurs it is not unnatural that one should expect to find a bursa here too And such a bursa was in fact described by Fleischmann of Erlangen<sup>1</sup> in the following word If from one or other side of the frenum one separates the mucous membrane from the tongue (Fig. 1) one finds close to the frenum resting on the genoglossus muscle behind the duct of Wharton and the ducts of Rivini a small mucous bursa oval shaped divided into cavities by cellular partitions the sublingual bursa the existence of which it is important to be acquainted with for a knowledge of ranula (italics ours) This bursa is lined throughout with a distinct epithelium Laterally it extends as far as the second molar tooth (Fig. 2)

Fleischmann was prevailed upon to make this bursa by Stromeyer who was struck by the similarity of the contents of several ranulae with the contents of other diseased mucous bursæ having found in the latter the starting point of ranula must be sought

in inflammation or other disease of the sublingual bursa and he was even convinced that *ranula arises through disease of the sublingual mucous bursa alone* (italics ours) the salivary ducts only at times being involved in the same affection. Personally from my experience with this and other cases but particularly with this case I feel very much inclined to agree with Fleischmann in effect my case thanks to the absolute exclusion through the first operation of the salivary glands as pathogenetic factors or participants in the ranula supports Fleischmann in every detail. Again I was struck by the similarity of the fluid of my ranula to the white of a raw egg a similarity that no stretch of the imagination can make for saliva. And it was Leopold Gmelin<sup>1</sup> who demonstrated that *the fluid of ranula has no similarity whatever with the saliva* (italics ours) sulphocyanic acid alkali being absent in ranula fluid while ranula fluid is rich in albumin which does not occur at all in healthy saliva.

I imagine that much of the confusion that has arisen in the interpretation of the surgical pathology of ranula could be dispelled by restricting the application of the term to the condition described above and illustrated by my case namely to hydrops of the sublingual bursa of Fleischmann. Although the

etymology of the term ranula is understood by the venest tyro in Latin namely as the diminutive of rana a frog yet it would clarify matters somewhat to learn the exact condition to which the term was first applied. I was unable to find who first used this term however. One surgical writer states that it is

possibly descriptive of the frog like appearance of patients when the growth is very large another that it has been derived

from the disease making the patient as it were croak when he attempts to articulate.

Now out of justice to my patient I must say that she neither looked like a frog nor did she croak like a frog but I will state unequivocally and in all sincerity that when I reflected the skin flaps and exposed the bluish white thin and lax cyst wall had a frog jumped out of the wound at this juncture I should have considered the pathogenesis of ranula settled for all time to come.

What I wish to convey by this hyperbole is to stress in your minds my feeling that not every cystic swelling seen in the sublingual space should be described as a ranula just because it happens to occupy that space but because its wall when exposed very closely resembles a frog's belly and no such cyst that I have seen bears anywhere near as close a resemblance to the amphibious abdomen of rana as this hydrops of the sublingual bursa of Fleischmann.

## ESTIMATION OF FATS CHOLESTEROL AND SUGAR IN THE BLOOD OF THIRTY PREGNANT WOMEN

By HELIODOR SCHILLER M.D. F.A.C.S. CHICAGO

PREGNANCY produces a voluminous increase in the metabolism and an augmented increase in catabolism. The variations in the constituents of the urine, the change in the respiratory quotient, the increased heat production resemble very closely the period of convalescence after acute disease and greatly surpass the metabolic activity during puberty.

To determine the cholesterol, the fat and blood sugar content of the blood I examined the blood of 14 pregnant women in the later months of pregnancy, 10 at term, 3 after parturition and 1 in the third month of pregnancy. In doing this I was well aware that similar examination had been made by much more competent men than myself but I had in mind studying the three subtraces parallel with each other in the same blood, a research which to my knowledge had not previously been made.

Table I gives the blood sugar in 30 pregnant women during the last month of pregnancy or during or soon after parturition. It can be seen at once that there is no change in the sugar metabolism from the normal in fact I can state basing this on some other work done one year ago that the amount of blood sugar is the same in all stages of pregnancy and the first few days after pregnancy and is within normal limits. I had the opportunity to examine the blood of two pregnant women with glycosuria and the percentage of sugar in the urine varied from 0.5 to 0.9. The sugar was discovered in the first woman at the sixth month in the second at the end of the seventh month. Repeated examinations of the blood for sugar showed values from 0.08 to 0.089 per cent, surely no hyperglycemia. Mammary activity the first week or two after parturition does not have a great influence on the blood sugar; the blood of the 3 women examined within 11 days postpartum had a sugar content ranging from 0.08 to 0.11 per cent within normal limits.

There surely cannot be a decreased liver function in so far as the sugar metabolism is concerned a fact we hear so often mentioned in explaining some of the toxemias of pregnancy. The part which the liver plays in sugar metabolism is normal. Nevertheless there is not infrequently found during pregnancy a glycosuria of a small degree and the susceptibility to alimentary glycosuria during pregnancy according to W. H. Morris in 37 per cent of the pregnant is an established fact. The ingestion of even so small an amount as 60 grams of glucose will produce a glycosuria so will the hypodermic injection of the smallest dose of adrenalin in 38 per cent of the pregnant. But to explain this evidence of low sugar tolerance through an existing hyperglycemia is incorrect. Hyperglycemia in pregnancy is the exception. For an explanation of the above phenomenon of low sugar tolerance we must consider the increased adrenalin and thyroid and hypophysis function and the lowered ovarian function during pregnancy. The importance of the chromaffine substance in the mobilization of sugar, the frequency of glycosuria in the hypertrophic conditions of the hypophysis, the augmented activity of a series of internal secretory organs, the hypertrophic conditions of the thyroid (and hypertrophy and hyperactivity of all these organs is present in pregnancy) explain the low sugar tolerance and the cases of glycosuria without hyperglycemia. I must mention that many authors consider the glycosuria of the pregnant as a renal disturbance, an increased permeability for glucose or a physiologic hyperfunction of the kidneys.

After the fourth month of pregnancy a storage of fat takes place not only in the fatty tissue but also in the blood, a storage needed for the nutrition of the fetus. The total blood fats which constitute (1) the true fats—glycerides of the fatty acids, (2) phosphatides—lecithin, cephalin, (3)

TABLE I

| C N | Ag | R m k                   | T m t T k g Specimen  | P g y | Bl od<br>S g t g | F t t y<br>A d t g | Ch l t l<br>P tag |
|-----|----|-------------------------|-----------------------|-------|------------------|--------------------|-------------------|
|     | 34 | Ced m f l g d i s 4 p d | 7 m th                | 3 d   | 0                | 85                 | 353               |
| 3   | 3  | H t b r m 3 po d        | 8 m th                | d     | 77               | 379                |                   |
| 4   | 5  | h m l l w m 3 po d      | 8 m th                | l     | 77               | 379                | 4.5               |
| 4   | 4  | N d m d                 | 7 m th                | t     | 77               | 354                | 9                 |
| 5   | 3  | q po d                  | 8-9 mo th             | t     | 8                | 355                | 46                |
|     | 3  | N m l p g y b t 3       | 9 m th                | 5th   | 5                | 49                 | 8                 |
| 7   | 7  | N m l r g n y h t 35    | 9 m th                | t     |                  | 4                  | 36                |
| 8   | 3  | N m l p 6 cy b t 5      | 9 m th                | d     | 67               | 49                 |                   |
| 9   | 3  | po d                    | 8 m th                | 3 d   | 9                | 555                | 00                |
|     | 9  | Ab t p d                | 9 m th                | t     | 8                | 555                |                   |
|     |    | Ab t s p l              | E d f 8th m th        | t     | 09 8             | 5                  | 7                 |
|     | 4  | N m l p g n a y         | E d f 8th m th        | t     |                  | 577                | 8                 |
| 3   | 3  | E l m f l               | 8 m ths               | 5th   | 09               | 568                | 85                |
| 4   |    | 6 ft                    | 6 1/2 m th            | t     | 78               | 577                | 5.3               |
| 5   | 9  | V y b o y w m d         | At t m                | t     | 35               | 397                | 500               |
| 6   | 6  | V r v t w m             | At t m                | t tw  |                  | 564                | 553               |
| 17  | 5  | N m l p d               | At t m                | d     | 37               | 49                 | 4                 |
| 8   | 4  | V r v t w m             | At t m                | 4th   | 8                | 54                 | 6                 |
| 9   | 5  | N m l p g n y 6 po d    | P t p l t a l b l d   | t     |                  | 5                  | 5                 |
|     |    | N m l p g y 6 po d      | P t p l t l b l o o d | 3 d   | 77               | 54                 | 8                 |
|     | 6  | N m l p g n y           | P t p l t a l         | t     | 5                | 54                 | 4.85              |
| 5   |    | N m l p d               | Postpl t l            | t     |                  | 49                 | 8                 |
| 4   |    | Ab o                    | Postpl t l            | d t   |                  |                    |                   |
| 5   | 37 | W g h t 6 1/2 p d       | 4 d y p t p t m       | th    | 33               | 444                | 8                 |
| 6   | 6  | 3 p e t g               | 5 w k postp r t m     |       | 05               | 57                 | 65                |
|     |    | q t g                   |                       |       | 3g               | 57                 | 500               |
| 7   | 4  | W g h t p d             | d y p t p r t m       | d     |                  | 555                | 8                 |
| 8   | 4  | N m l p 8               | w k p t p r t m       | t     |                  | 57                 | 7                 |
| 9   | 5  | S m l p 7               | d y p o t p r t m     | d     |                  | 555                | 4                 |
| 5   |    |                         | 3 m th                | d     |                  |                    | 65                |

the cholesterol are outside of alimentary lipemia remarkably constant for normal individuals. It has been found that the true fats the glycerides of fatty acids neutral fats in the blood are during the time the alimentary tract is free negligibly small (Letschke Kemperer). During digestion especially after a meal rich in fats an alimentary lipemia is found an addition of tri glycerides to the blood and the tri glycerides are added directly to the blood by way of the intestinal capillaries. The presence of this suspended fat in the blood persists for some hours—8 to 12—and then disappears. At other times there is a mobilization of fat from normal fat deposits which during starvation might augment the blood fat.

So found Neuman

|                   | E m t t h m<br>ft t g | E m t t h m<br>ft t g |
|-------------------|-----------------------|-----------------------|
| Total blood fats  | 5.46                  | 6.26                  |
| Cholesterol       | 0.0                   | 1.03                  |
| Chol sterol ester | 0.5                   | 0.82                  |

If we find in the blood at a time when the alimentary tract is free an increase in the blood fats we have to deal with a lipoidemia an increase in the lipoids fat like substances constant intracellular and extracellular constituents of the blood which are soluble in ordinary fat solvents but are not simple fats or fatty acids. Their main representatives are cholesterol and lecithin. Under normal conditions they are found in the same percentage in the same individual or species. They show an alimentary increase as do the true fats. In the tests which I have made I have used the blood just before breakfast.



to exclude alimentary lipemia or lipoidemia. In the cases where postplacental blood was taken the women had had hardly any nourishment for 12 to 15 hours.

The very rapid and decided increase in the percentage of lipid and cholesterol in the blood after intake of food shows definitely that the substances are in some way or other absorbed by the intestines out of the food and get into the blood. But surely not all the lipids are of this exogenous origin.

Some of them are undoubtedly the product of metabolism of the tissue cells. The hepato-genic origin of some of the cholesterol seems to be proved by parallelism existing between the increase in the cholesterol content of the blood and the increase in the excretion of bile acids. The fact that the liver and other organs and their different tissue cells respectively contain lipid characteristics of them would substantiate their own lipid synthesis, their ability to build and consume fat and lipoids. It is believed for instance that the organism is able to produce phosphatides from triglyceride. Still it has been shown that animals fed not only artificially freed as much as possible of lipid in spite of addition of large amounts of organic phosphates will die they die of lack of lecithin and cholesterol. Of special interest are the cholesterol esters which are present in the blood serum; they are connections between cholesterol and fatty acid and would be the means of fat metabolism of the transportation of fats; its synthesis and the excretion of fatty acids on the one hand leading toward the acid component of the fatty acid, on the other to the lipoids; they build the link which unites connection or present such as the lipopeptides or lipoproteids, the link between lipid and protein. A great deal about the origin of the lipid of the body, their resorption or assimilation, their entering into the cells or separating from them likewise their function is mostly theory.

How is this hyperlipoidemia, hypercholesterolemia in pregnancy to be explained, what is the ultimate cause? In seeking other conditions which show hyperlipemia we find a similar increase or higher amounts in patients with diabetes mellitus in patients

suffering from starvation and various forms of anemia, chronic nephritis, carcinoma, chronic alcoholism and after prolonged anesthesia while in some of the infectious diseases—not pneumonia—the level of the lipoids sinks low and rapidly. The high level in alcoholism is explained through the fact that the alcohol furnishes an easier burning material than the lipoids protecting them in the infectious diseases, the protecting agents which the lipoids exert use up the lipoids. An explanation for the hyperlipemia or lipoidemia lies in the assertion that we have to deal with an alimentary increase of the fatty substances. It is pointed out that the pregnant show an increased appetite during the second half of pregnancy and that the pregnant sometimes of their own volition sometimes on the advice of the medical profession increase the quantity and quality of the food taken to such an extent as to overbalance the demand of the fetus for many pregnant women live a quiet and easy life and do not require this increase in amount of food. But this exogenous moment does not hold true. I have in my list two patients who suffered from frequent vomiting for 3 weeks previous to the time the specimen was taken but their cholesterol percentage was higher than normal. Not all pregnant women show an increased appetite, many work hard until partus. It also cannot be presumed that this higher lipoidemia is the result of an increased mobilization of the fat from the normal fat deposits of the body to the blood. The normal adipose tissue does not contain lipoids to any extent and the subcutaneous fat in pregnancy is increased and not decreased. Impaired oxidation as an analogy to pneumonia has been enumerated as a cause but oxidation in pregnancy is increased and not decreased.

Sagol found the lipolytic enzymes of the blood, the lipase reduced in the pregnant. In pregnancy a condition of marked growth and energy the lipase should be diminished thus explaining the high level of the lipoids. But other authors doubt the existence of a direct lipase in the blood and concede only an ester splitting ferment.

Kempner explains the hyperlipæmia in diabetes as a result of increased cell disintegration with the consequent freeing of lipoids especially the cholesterol the least soluble of them the integration of cells a necessity for the building of new cells. Similar conditions exist during pregnancy a vast amount of lipoids so necessary for the metabolism and such growth stimulants as the lipoids represent are needed for the fœtus. Furthermore the large amount of lipoids which the fœtus extracts from the maternal organism simulate a condition in the mother such as we find in a patient suffering from chronic anemia or carcinosis. But no definite finding substantiates this analogy. Furthermore there is nothing definitely known or observed about the ways and means of how maternal fat reaches the fœtus via the placenta of late some investigators give to the chorionic villi the same role which the villi of the intestines play in the fat absorption. Quantitative estimation of the fats and lipoids of mother and fœtus gives widely different values for both showing that there is no equilibrium between the two concerning the fatty substances.

Slemons believes that the hypercholesterolemia is possibly the result of cholesterol transportation from the fœtus to the mother. Hypercholesterolemia begins with the fourth month of pregnancy at a time when fat metabolism becomes active in the fœtus. Cholesterol according to Slemons a waste product should thus pass from fœtus to mother. If this is true we should find very high values of cholesterol in twin pregnancy. In the two cases of twin pregnancy I examined the cholesterol content was not abnormally high.

Cholesterol is an antitoxic substance it forms a protective mechanism for the body it is able to neutralize poisons and toxins it weakens and destroys the hemolytic action of saponin and shows quite especially an affinity for these toxins which are produced in the metabolic processes. Many point out these properties of the lipoids and believe their increase a necessity as a protective means for the maternal organism.

The most unconstrained explanation of the phenomenon of hyperlipoidemia in preg-

nancy can be found in the changes of the internal glands during pregnancy. Under normal conditions the adrenal glands the thyroid the hypophysis and the ovaries and other internal organs have a regulating influence upon metabolism. Their connection with the generative system is proved by the constant finding of the hypertrophic and hyperplastic conditions and by their histological changes during gestation.

If we regard the ovary as of first importance we must consider some work done by Herrman and Neumann who found hyperlipoidemia as a constant condition shortly after castration and shortly after cessation of menstruation or cessation of the function of the corpus luteum. They found the same to be true in cases of amenorrhœa through chlorosis—hypofunction of the ovary. Lindemann made the same observation and found especially the cholesterol esters increased. With the loss or hypofunction of the ovary a distinct decrease in the catabolism of the organism takes place (Loewy Richter) we find that castration disposes in at least 50 per cent of the cases to adiposity. Of course it must be mentioned that this obesity appears in only about 50 per cent of the cases and that the hyperlipemia following castration is temporary only gradually disappearing while in pregnancy it gradually increases. Therefore we must direct our attention to some other stimulants which are easily found in the other endocrine glands. All glands of internal secretion possess qualities similar in their influence upon the metabolism. This explains how one can easily substitute one for the other it explains the interaction between the glands. By the action of hormones from the ovary there may exist an interaction between liver and ovary and corpus luteum.

Injection of the watery extract of corpus luteum (P. D. & C.) into the blood produces rapidly a temporary hypercholesterolemia. The same result is obtained from adrenal injection. How much the other endocrine glands interact during pregnancy is not definitely known but the physiologic hypertrophy of the hypophysis and thyroid and the constant and enormous increase in the chro-

maffine cells during pregnancy point out their close relation to the increase in fats and lipoids during gestation. The increase in the adrenalin glands during pregnancy of the cholesterol content and its esters is by some investigators believed to be great enough to explain the phenomenon of hypercholesteræmia but Biedel has pointed out that this cannot be true as cholesterolin karabat the main representative of the cholesterol ester in the adrenalin is not present in the blood. These last mentioned findings surely point to the close relationship between changes in the maternal blood and the physiologic changes in the glands of internal secretion. Still the ultimate cause of hyperlipoidæmia has yet to be found. The fact remains that pregnancy is the greatest factor for the internal glands play only an indirect part. Kauts seeks the final cause in the syncytium and believes that substances produced in the placenta especially the nucleic acids enter the maternal blood and produce all the changes reactions and hyperfunctions with the result hyperlipæmia or lipoidæmia. Lindeman on the other hand says: The fœtus is like a parasite it takes up valuable material from the mother's blood and she is in a condition similar to the diabetic who loses sugar or the nephritic who loses albumin. For its existence and for its growth the fœtus is entirely dependent upon the mother and it produces in the organism of the mother a rapid mobilization of lipoids therefore we find the lipoids increased in the mother's blood and steadily increasing in the little months of pregnancy with the increased demand.

It can readily be seen if we compare the normal findings with those of the pregnant that in pregnancy there is a true hyperlipæmia and hypercholesteræmia. Since there is a constant parallelism between the increase of the cholesterol and cholesterol esters and lecithin we can easily figure out that the increase of the total fatty substances lies on the side of the lipoids.

The low cholesterol reading in some of my cases does not mean an absolute low cholesterol content of the blood in these women. Different investigators find the cholesterol content of the blood to vary in the normal from 0.11 to 0. It is possible that the cases of my group with a rather low cholesterol content are the ones who have normally a low cholesterol content around 0.1 or 0.12 and figures as low as 0.17 would mean a decided increase.

#### CONCLUSION

1. There is no hyperglycæmia in the later months of pregnancy or in the first two weeks after pregnancy.

Glycosuria and alimentary glycosuria during this period can be explained by the activity of the glands of internal secretion or as a renal hyperfunction.

3. Hyperlipæmia in pregnancy is in reality for the most part a hyperlipoidæmia.

4. There is no parallelism between cholesteræmia and hyperglycæmia in pregnancy.

5. The etiology of this condition is as yet not established.

6. It seems that the endocrine glands are to be looked upon as an important factor.

| E t y and<br>total w m | h blood f<br>di Bl | Ch l<br>u l w m | h blood f<br>d g Bloo |
|------------------------|--------------------|-----------------|-----------------------|
| 345                    | 6                  | 95              | 84                    |
| 300                    | 0.33               | 7               | 0.8                   |
| 300                    | 0.263              | 97              | 5                     |

I w h t e r p s m y t h k s t J o p h D e L e f o p e  
m t t g e m t u t t h e m a l l f i t h e L y n g I H s p t l  
a l o m y t h u k t W t h r o w M o P r f e  
P h y l g t l C h m t r y f t h U r t y t W e t A  
g m d t M L L g b r g h m t f t h N l o  
M i n u t t f M e d c a l R h f t h e m  
l u b l a t

## THE TECHNIQUE OF GALL-BLADDER AND COMMON-DUCT SURGERY

B. H. M. RICHTER M.D. F.A.C.S. CHICAGO

THE technique of gall tract surgery is in process of becoming standardized. It is still in the course of its development as evidenced by the very material variation in the operation as described by the various contributors to the subject. Some underlying principles involved seem rather frequently to be overlooked hence the following rather short contribution. As we are interested in but a few phases of the technique we shall not consider the operation as a whole but only those points that we wish especially to emphasize.

*Enucleation of the gall bladder.* Most writers seem agreed that the cystic duct should be isolated before division to insure the safety of the common duct. But as in recent years a larger proportion of acutely distended gall bladders are removed rather than drained it is frequently found that the cystic duct is not easily reached without the preliminary emptying of the gall bladder. Particularly is this true where the preliminary rotation of the liver is not readily or perfectly accomplished. The tense gall bladder pushes the cystic duct backward and upward away from the operator since the fundus is fixed to the liver and the apex is the only mobile part and must therefore be the most disturbed part. It will be found that a tense gall bladder will lift itself out of the incision into the operator's hand if it is first released from the liver. This is accomplished by splitting the peritoneum as it is reflected from the liver on to the gall bladder just enough to admit a finger. The finger is inserted and the gall bladder peeled out of its bed. In the course of its enucleation more of the peritoneum may require cutting although most of it will readily tear. The release of a tense gall bladder in this way will cause the fundus as stated above to push its way out of the incision almost into one's hand and bring its apex measurably within control. In this way the cystic duct is mobilized and made easily accessible. It

is a fact that peeling out the gall bladder in the opposite direction—from the apex toward the fundus—is somewhat cleaner since the vessels are caught before their branches are torn but this is a matter of but a moment's time and the loss of blood will usually be trifling if the plane of cleavage between gall bladder and liver is not lost.

*The cystic duct.* The cystic duct should I believe rarely be clamped with its vessels, tissues and peritoneum *in toto*. It is much cleaner technique to break or split the overlying peritoneum and clamp it after having isolated it. It is quite unnecessary to ligate it close to the common duct; one must avoid the careless ligature of the apex of the gall bladder itself lest a continued infection of the stump of the gall bladder remain a danger to which C. H. Mayo and others have called attention.

It is an odd fact that many writers insist upon severing the cystic duct close to its termination in the common duct. Their suggestion is based mainly upon the well known fact that the stump of the cystic duct tends to enlarge after removal of the gall bladder and they assume this to be objectionable. But the cystic duct is probably as rarely the site of origin of stones as are the other ducts. Stones have been left behind in the cystic duct but that should be charged to careless technique. The very absence of any number of reports on recurrence of trouble in the stump of the cystic duct other than that due to stones left behind should suggest that it is rarely the source of trouble. Hans Kehr reports having removed *one* such duct that had attained a length of 10 centimeters but fails to state the reason for its removal. The other cases have reference entirely to stones that have been left behind.

*The flaps of peritoneum.* In peeling out the gall bladder the finger naturally finds the plane of cleavage and with little care the liver substance is not torn on each side part of the peritoneum is peeled off the gall

bladder to be left behind to cover in the denuded liver. But these peritoneal flaps are of minor importance and should not be sutured over the denuded liver merely pressed against it. In this way the flaps will adhere as a Thiersch graft. Suturing tends to lift the flaps out of their depressed bed leaving a space behind and adds a needless step to the operation.

Pentonealization is a fetish that calls for many an extra half hour of worship when the surgeon might better be employed in closing the abdomen.

*The raw surface.* The denuded surface of the liver is partially covered as suggested above but this step in the technique is of but slight importance. The position of the raw surface is such that massive adhesions to it are naturally objectionable but the surface itself is depressed and not exposed to contact with adjacent structures and adhesions would be minimal were it not for other factors scarcely affected by drawing the peritoneal flaps across. The gauze pack is a much more potent cause of adhesion than the raw surface *per se*. A satisfactory method too of minimizing adhesions is that suggested by E. Wyllis Andrews of dropping the omentum in between the liver and the duodenum. It is rather the oozing from this surface that may be important and possibly to some extent the leakage of bile from the torn surface. The treatment of the flaps suggested above is by far the best means of taking care of this. Oozing from the liver surface may be sufficient to make closure unsafe though this is exceptional. The use of one of the newer hemostatic preparations on the order of coagulose may prove valuable. My experience with the powder dusted on the liver, thyroid and brain surfaces has been satisfactory. Packing may sometimes be avoided in this way.

Bile leakage from the liver surface may be a factor in producing an otherwise unaccountable postoperative reaction.

*The treatment of the ligated stump.* Though many operators close the abdomen without drainage it is almost universally suggested that drainage should be instituted after cholecystectomy apparently without con-

sidering the advisability of closure without drainage. An exception is in the paper of A. Murat Willis who reports a series of thirty-eight cholecystectomies without drainage with one death. But he makes the peculiar basic error of excluding his stump from the peritoneum.

The end of the stump may fairly be regarded as infected usually in the mildest degree. The peritoneum is quite well able to care for this infection. Willis' cases show that even if buried outside of the peritoneum where the tissues are least able to care for infection no harm is done but this stump should be left free in the peritoneum. It is crushed which thins it out leaving but a minimum of mucosa behind ligated with a very moderate sized catgut (No. 0 or No. 1) and then just left alone. In our first cases we touched up the stump with iodine or carbolic acid a needless rite.

The abdomen is now closed without drainage.

While this paper was intended primarily to discuss the technique of cholecystectomy particularly with reference to the closure of the abdomen without drainage I wish to add a word regarding the similar closure of the abdomen after opening the ducts. Provided no obstructive lesion is left behind it is illogical to drain the common duct or leave a tube in it following cholecystectomy. With the duct free of obstruction the distal orifice in particular being open the normal drainage into the duodenum is superior to the usual methods in vogue.

Here as in cholecystectomy the absence of the reaction and infection about a gauze pack or other form of drainage results in a much smoother convalescence with fewer postoperative adhesions to leave a trail of late sequelae. Kehr stated some years ago that Koerte and he had given up immediate suture of the duct because of the danger of obstruction but leave a tube in the duct for 10 to 15 days and this is the usual procedure. Primary suture of the common duct is of course no new idea. It has however repeatedly failed and drainage is regarded as the keynote of safety. But the common duct

has a peritoneal covering on the exposed surface through which the incision is made and if the operative work has been complete it is as illogical to drain this line of suture as a similar line of suture in stomach or in testine

It is an essential requirement in carrying out immediate suture that the common duct should be patent that no stone in the ampulla no partial closure of its orifice from a thickened muscle of Oddi or chronic pancreatitis should be present If a good sized sound or scoop cannot freely be passed down the common duct into the bowel a duodenotomy should be made to investigate the orifice direct or the orifice should be slit up or stretched if required It is here I believe that even the skillful surgeon has often erred and has found it necessary to improvise external drainage to compensate for his failure to convert the common duct into the best possible drainage tube and drain the tube in the best possible place the duodenum

In my service at the Wesley Memorial

and Cook County Hospitals I have carried out the idea of closure of the abdomen with out drainage in all gall bladder removals or common duct operations except where unusual oozing from the liver surface made a gauze pack seem necessary or where the apparent virulence of an acute infection made me fear a fulminant peritonitis The number of cases has not been large but there has been no death in the series The post operative recovery has usually been smooth

like an uncomplicated appendix case to use the expression of one of the house surgeons A few cases have shown a reaction suggestive of what is commonly seen in patients in whom a gauze pack has been used It has seemed to me that the leakage of infected bile from the denuded liver surface might possibly be a factor in the production of this reaction It has not been necessary to reopen the abdomen in any case No patient has developed an unusual temperature The abdominal incision in all cases has remained clean

## GANGRENOUS APPENDICITIS COINCIDENT WITH LABOR

AN UNUSUAL CASE OF THE INITIAL ATTACK OCCURRING IN AND OPERATED UPON DURING THE FIRST STAGE OF FULL TERM LABOR IN A PRIMIPARA DELIVERY RECOVERY<sup>1</sup>

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F m b C p t M C U S A W t P u t N Y

IT was the intention of the writer to render a report of this rare coincidence by incorporating the case report in a review of the literature on acute appendicitis complicating labor To my great surprise a perusal of the *Indices Medici* for the past ten years under the headings Surgery of the Appendix and Complicated Labor did not result in the finding of a report of a single case of appendicitis operated upon during the active process of labor

The following facts add to the rarity of the case (1) the patient was a primipara (2) she had never had an attack of appendicitis or any type of abdominal pain up to the

time of the event (3) she had had a perfectly normal gestation course promising nothing unusual

Williams of Baltimore in his textbook mentions two cases which he saw in consultation but has had no case in his own practice Hirst of Philadelphia in his extensive paper on The Diagnosis Treatment and Management of Surgical Conditions Complicating Pregnancy does not cite any instance of appendicitis coincident with full term labor Hirst's textbook (various editions) does not mention any specific case of an initial attack of appendicitis complicating labor Criggin's textbook does not mention any

definite instance of similar circumstances DeLee and the *American Textbook of Obstetrics* were searched with no better result.

The writer desires to place on record the case about to be described first because of the extreme rarity of acute gangrenous appendicitis with beginning peritonitis coincident with full term labor second because the attack of appendicitis was the patient's first attack—she denies emphatically ever having had abdominal pain at any time during her life third because of the stormy and eventful postoperative course fourth because of the eventually satisfactory and complete recovery.

**Medical History.**—A married woman of exceptional intelligence good health and habits. The family history having no bearing upon the condition at hand may be considered as normal. The personal history represents no exception in health or intelligence. As defecation the mild rashes of childhood the only condition for which she had consulted a doctor as the other common sequelae of menstruation in the early months of gestation. This symptom had disappeared before she came under my observation.

**Physical Examination.**—The patient came for her first examination on June 10, 1918. She had no complaints whatsoever. The general examination showed a vigorous young woman of thin but well built. The heart, lungs, head, neck, and extremities were negative. Bimanual and abdominal palpation defined a vertebral position with small tenderness in the right back and heat sound to the left. Mammary glands moderately enlarged with a serous secretion from the nipples. Bowels and urination normal. Urinalysis negative. Complete bimanual and abdominal examinations repeated every two weeks to within one week of term revealed no abnormal physical condition. Aside from the ordinary discomfort due to the activity of the fetus the patient never experienced any abdominal pain at any time. Weekly examinations of the urine were consistently negative.

All the obtainable data served but to emphasize the unusually uneventful course of gestation.

Calculation based upon (1) the probable date of concept on (October 2, 1917) (2) the first day of the last menstruation and (3) the descent of the uterus at the twentieth week indicated that the expectant date would be between July 15 and 20.

**Diagnostics.**—At 10:00 a.m. on July 15 I was called by telephone to suggest something to relieve epigastric distress which had started earlier in the evening and had increased to vary midnight. Slight nausea accompanied the distress but no pain anywhere. Alkaline discharges did not relieve the distress. Castic lavage and an

enema were given at 8:30 a.m. and relief followed and lasted throughout the day and evening of the 15th and the morning of the 16th. At 3:00 p.m. on the 16th the nurse reported a temperature of 99°. This was the first rise since the trouble began. At 8:00 p.m. the temperature reached 101°. There had been no labor pains and no abdominal pain during the period of temperature up to this point.

At 7:00 a.m. on the 17th the temperature was 100.4° and the palpation revealed for the first time abdominal tenderness favoring the right iliac and lumbar regions maximal at a point 1.5 inches above the anterior superior spine. Tenderness could also be elicited in lesser degree in the left iliac region.

The antecedent history gave no aid in making the decision as the patient had had no pain of any kind in her abdomen as far back as she could recall. The point of maximum tenderness was high and external to McBurney's point but allowance was made for the upward displacement of the intestines by the full term uterus and a diagnosis of acute appendicitis was made. To add to the difficulty of reaching this alarming conclusion (which conclusion all parties concerned including the patient were loath to admit) the patient began to complain of infrequent and irregular but nevertheless definite regular pains beginning in the small of the back and migrating forward and downward to the hypogastrium. Examination revealed a beginning dilatation of the cervix.

The difficulty of convincing oneself of the real state of affairs in a diagnostic dilemma of this kind can scarcely be exaggerated to say nothing of forcing the acceptance of such a conclusion upon a couple married less than a year and neither of whom had experienced any illness prior to this. However both the husband and wife acted independently well under the circumstances and agreed upon a consultation and immediate operation if the consultants concurred in the opinion.

**Consultants.**—Lieut. Col. Wm. H. Haskin, Post Surgeon, examined the patient at 8:30 p.m. and agreed with the diagnosis. Major Charles Townsend of the New York State Guard on duty at Newburgh, New York, was asked to see the case. While waiting for Dr. Townsend the patient was removed to the hospital and preparations were made for all possible agencies both operative and obstetrical. Difficulties in transportation between Newburgh and West Point delayed the second consultation until 1:00 p.m. Dr. Townsend also concurred in the diagnosis and kindly consented to assist in the operation.

**Operation.**—The operation was begun at 11:55 p.m. (July 19, 1918) and ended at 12:35 a.m. July 18. Chloroform anesthesia was administered by Colonel Haskin. The gravid uterus occupying the entire anterior aspect of the abdomen necessitated a high and extremely lateral incision. An oblique incision four inches long was made beginning at the flank at a point one inch below the iliac crest and extending downward and parallel to Poupart's liga-

ment to a point one inch below and mesial to the anterior superior spine. The lumbar and abdominal muscles were divided bluntly and retracted giving an exposure of peritoneum very similar to the exposure sought in removing a calculus from the middle third of the right ureter. The peritoneum in this instance being opened instead of being retracted mesially. Division of the peritoneum resulted in a gush of several ounces of fluid of a slightly turbid character. The fluid was evidently of general distribution. The gravid uterus seemed to occupy all the available space. A pad was placed over it and it was held to the left while the operator inserted his hand upward toward the gall bladder region in an attempt to locate the upwardly displaced cecum. A tense fluctuant sausage shaped mass was located in the same region. The cecum was pinched between the index and middle fingers while the fusiform mass attached to it was allowed to rest in the palm of the hand. Traction downward was exerted then with great care upon the cecum. When delivered into the wound the mass proved to be a completely gangrenous appendix distended with fluid but luckily as yet unperforated. The proximal half inch was still firm enough to ligate and after being crushed with a clamp was tied with No. 3 plain catgut. A scalpel dipped in pure phenol was used to divide the appendix between the ligature and the clamp thus carbolizing the stump and the open end of the appendix at one time. The amputated organ was removed without accident. No attempt at inversion or burying of the stump was made. A rubber tube drain  $\frac{3}{4}$  inch bore was led from the site of the appendix and another from the right pelvis to the center of the wound. There was no localized exudate to drain either above or in the right pelvis. The peritoneum was closed with No. 3 plain catgut continuous suture the drainage tube exit being made at the lower central part of the wound. The muscles were closed with No. 2 plain catgut interrupted mattress sutures the fascia with No. 3 plain and No. 3 chromic alternating mattress sutures. Through and through sutures of double silk worm gut were passed through the skin, fasciae and muscles and tied over gauze rolls above and below the exit of the drainage tube to insure firm pressure along the entire length of the wound.

The details of the closure are given because it was considered of prime importance in view of the impending labor with its resultant strain on the abdominal musculature.

The appendix was fusiform in shape dull on the peritoneal surface the coats thinned by distention and the lumen containing about two drams of foul sanguinous pus. The organ was in the preperforative stage of gangrene the muscular coats being in a state of dissolution. The slightest pressure with a scissors at the center of the distended organ was sufficient to cause it to scatter its contents over the specimen basin demonstrating the tension within. A coprolith was found at its proximal end. There was no omentum adherent to the surface.

The patient returned from the operating room in excellent condition and reacted from the chloroform anesthesia without vomiting. One half hour after regaining consciousness the patient complained again of girdle pains starting in the back and radiating forward and downward. The intervals were 15 minutes with regularity. One eighth and one sixth grain doses of morphine sulphate hypodermically had been given five hours and fifteen minutes respectively before operation. Another dose of one eighth grain was given two hours after the patient returned from the operating room and she slept from 3:00 a.m. to 4:00 a.m. when the nurse reported a gush of fluid following a severe bearing down pain.

*Second stage of labor.* Inspection revealed ruptured membranes with the caput appearing with each pain. The pains were then occurring at ten minute intervals with regularity and increased severity. The pains were not causing any undue discomfort in the wound. Complete dilatation was effected at 9:00 a.m. The patient's bed was removed to the operating room and the obstetrical instruments and lung motor were kept in readiness.

*Delivery.* The patient was allowed 45 minutes to deliver the head. At the end of this period she complained of pain in the wound and because of the recent operation nine hours before we agreed to give her a second chloroform anesthesia and assist with low forceps application. The head was delivered under partial narcosis the shoulders and small parts following easily. No laceration except a slight mucous separation about three quarters inch long was found. This did not require suture.

*Third stage of labor.* The placenta was delivered with membranes complete 35 minutes after the completion of the second stage and the uterus contracted normally and without hemorrhage. One fifth grain of ergotin was administered hypodermatically and attention was directed to overcoming the apnoea of the baby.

*The baby.* The usual manual and hydrotherapeutic measures were used for 10 minutes during which time the pulse remained regular and of good quality. A few spontaneous respirations occurred during this period but cessation of our activities resulted in cessation of the respiration. The lung motor in conjunction with oxygen was applied. The cyanosis diminished and after 35 minutes of intermittent use of this appliance the respirations continued spontaneously and the baby emitted lusty cries. There were no forceps marks and no paralysis of the face or extremities. The heart sounds were normal. The weight was 8 pounds 1 ounce.

As far as could be determined we had delivered a full term baby who had given us a little unusual trouble in establishing normal respiration. However at 12:45 p.m. two and a half hours after the delivery the nurse reported cyanosis and apnoea with heart action regular. The lung motor was reapplied and after 20 minutes respirations re-



established themselves and the baby seemed as well as before. Lusty cries and muscular activities were indulged in and no further trouble seemed imminent. At 3.3 p.m. a second recurrence of apnoea was reported. It required 1 hour and 5 minutes of artificial respiration this time and thins were as before. The heart maintained its regular action throughout. At 5.00 p.m. a fourth attack of apnoea started. All means failed us this time. The heart became irregular and the baby ceased to breathe at 5.2 p.m.

*Cause of death of the baby.* We catheterized the baby and examined the urine for traces of morphine thinking perhaps that the three doses administered to the mother before and after the appendectomy might have affected the respiratory center of the foetus. No evidence of the drug was found by the toxicologic analyses. As the child lived for an and a half hours after delivery and seemed perfectly normal between the attacks of apnoea with no evidence of facial or limb paralysis it felt justified in eliminating forceps injury as a cause. There were no marks on the child's head as the manipulation was gentle and of short duration as evidenced by the absence of perineal laceration although the mother was a primipara.

The most reasonable explanation seemed to be derived from the mother as a result of the acute purulent (empyema) appendicitis. This diagnosis seemed supported by the postoperative course of the mother about to be described. Postmortem examination of the child was refused.

*The mother.* The mother returned from the operating room in excellent condition having had the usual postpartum chill. The first postpartum (and postoperative) day was spent uneventfully, slight nausea and inability to void urine being the only complaints. Fluids were taken in small quantities for the first 24 hours. Four hundred cubic centimeters of urine were obtained per catheter at 8.30 p.m.

Codine sulphate grain was given at 9.1 p.m. This carried the patient through until 12.10 a.m. when she awoke and vomited a large amount of mucous and bile stained fluid. At 4.00 a.m. of the second day 330 cubic centimeters of urine were obtained per catheter. A second grain dose of codeine was given at 4.30 a.m. The patient slept until 9.00 a.m.

At 9.15 a.m. the nurse reported a noticeable irregularity of the pulse. Digitalin milligram intravenously was given and a continuous Murphy drip started to control the throb.

No symptoms of intestinal bleeding were in evidence. The pulse again lapsed into an irregular and rapid rate (at 11.15 a.m. and accelerated to 60).

Hypodermoclysis was started and after 25 cubic centimeters had been given the pulse had become imperceptible and an intravenous of saline was started without delay. No response was obtained until 400 cubic centimeters had been given and milling amount of digitalin with 10 minutes of adrenalin added through the intravenous tubing.

At this point the pulse became palpable and as the intravenous continued the pulse improved in quality rate and rhythm. Six hundred cubic centimeters in all were given. The consciousness returned.

One hour later morphine sulphate 1/6 grain and atrophine sulphate 1/50 grain were given for restlessness. An eighth of morphine with 1/30 of strychnine was given at 11.15 a.m. and at 1.25 p.m. a small enema of hot coffee, ounces whisky, 1 ounce and saline 2 ounces was given.

Catheterization after 9 hours returned only 75 cubic centimeters of urine in spite of the Murphy drip and the intravenous. Both of the acidified specimen showed a solidification of 25 per cent by volume of albumin.

The cardiac collapse and the repression of urine with marked albuminuria in the mother convinced us that the death of the baby had been from toxic causes derived from the mother. The cardiac failure was evidently a toxic myocarditis due to retention of toxins as a result of the suppressed eliminative function of the kidneys which organs were in turn suffering from the toxins.

The critical state of the patient was discussed in consultation with Dr. Frank S. Mathews of New York and Dr. Townsend of Newburgh. The sound was examined and found innocent as a cause of the trouble. The discharge was serous and without odor, no any suggestion of purulent material. The pelvic drainage tube was removed at the suggestion of Dr. Mathews. Forcible fluids hypodermoclysis, Murphy drip and constant heat applied by an electric pad to the lumbar region were agreed upon as the best means of retaining and increasing the function of the kidneys.

The first nine hours of continuous Murphy drip showed a retention of 950 cubic centimeters. During the fifteen hours from 9.5 a.m. to midnight 51 cubic centimeters of urine were obtained at two catheterizations of 250 and 60 cubic centimeters each. The 25 per cent volume precipitate of albumin had reduced to about 10 per cent volume.

At 4.15 a.m. (this of the third day postoperative) the best showed signs of repeating its performance of the previous morning and the following measures were resorted to: (1) digitalin 1 milligram intravenously, (2) caffeine sodium benzoate 1 grain intramuscularly, (3) repetition of digitalin 1 milligram 1 hour and 15 minutes later for persistence of the urinary of the pulse and a rate of 160. (4) trypan blue sulphate 1/2 gram two hours after the first medication for tonic effect. As a result the irregularity of the pulse disappeared. The quality improved but a dicrotic character persisted for 9 hours.

From midnight to 10 p.m. of the third day 375 cubic centimeters of urine were obtained by catheter. 450 cubic centimeters of the Murphy drip were retained in the 24 hours. The saline was changed to 5 per cent glucose for nutritional purposes the whisky being increased from 3 cubic centimeters to 45 cubic centimeters per 1000 cubic centimeters

Fluid by mouth was increased and varied to stimulate appetite 1 ounce every hour of either albumin water champagne or cracked ice being given. Codeine sulphate in 1 grain doses was used every 4 hours or more as indicated. In the 8 hours from 30 to 10 00 p.m. 500 cubic centimeters of urine were obtained by catheter. Just a deep cloud of albumin remained.

This was a real improvement in the quality and quantity of the kidney output. The fluid intake was pushed and the electric heat to the lumbar region was continued. Continuous improvement followed from day to day under stimulation as indicated and forced feeding. On the fourth day the remaining drainage tube was replaced by a No. 20 French catheter as the discharge had almost stopped.

On the fifth day the temperature rose to 101 and later to 10. This was reduced by enemata. A slight icterus which appeared with this temperature rise disappeared in 2 days. Nothing was found in the wound or vicinity to account for the temperature so the catheter was removed from the wound on the eleventh day.

On the sixteenth day postoperative the patient was removed from the hospital to her quarters. On the second day at home the temperature rose to 104. This continued two days. No local complaints were registered. Vaginal examination revealed nothing and there was no pain in the wound. On the twenty second day the patient complained for the first time of pain along the crest of the ilium to the outer side of the wound. An anæsthetic was given and the remains of the drainage point of the wound was opened by stretching with graduated metal urethral sounds until the index finger could be inserted. A boggy sanguinous exudate devoid of visible pus was found to the outer side of the wound. It corresponded to the muscular layer and the peritoneum seemed firm and healed. The exudate was broken up with a sweep of the finger and a rubber tube inserted. The temperature dropped and remained normal after three days. The tube was removed and the patient allowed to walk about the house. The wound healed and except for a slight superficial abscess opened a week later while I was on leave by Colonel Haskin the patient had no further trouble.

A final vaginal examination revealed a uterus normal in size fully involuted and free to be moved in all directions. There was no residual pelvic exudate of any kind or location which seems most unusual considering the conditions of the drainage. The breasts gave no trouble of any kind at any stage after the birth and save for the daily application of boric acid alcohol solution had no special attention

## SUMMARY

1 A young vigorous woman a primipara with a negative history normal obstetrical outlook and no complaints.

The simultaneous occurrence of early labor pains with abdominal symptoms ending in the diagnosis and operation for appendicitis.

3 The removal of a totally gangrenous appendix filled with pus and about to perforate. A beginning peritonitis of a sero purulent character.

4 The delivery of a normally formed and developed full term baby and placenta. A state of apnoea in the baby lasting 45 minutes with good pulse followed by a normal period of 3 hours. The recurrences of the apnoea with normal periods between finally ending in failure of the baby's heart action and death seven and a half hours after delivery. The apnoea was probably toxic from the pus in the mother's appendix.

5 Almost fatal postoperative complications of the mother i.e. her cardiac and renal failure almost of fatal termination and undoubtedly of toxic origin from the appendix. A subsequent jaundice an evidence of the effect of the toxæmia upon the liver function.

6 Complete recovery without residual pelvic exudate and with cardiac renal or other residue of the complications and without invalidism of any kind.

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## PROGNOSIS IN HYPERTHYROIDISM

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THE term exophthalmic goiter has generally given way to that of hyperthyroidism or thyrotoxicosis since careful study has shown that exophthalmos is usually absent and the goiter may be. The only essential feature in the pathogenesis is that a toxic product or an excess of a normal one is produced. All my cases that have come to operation have shown evidence of organic or tinctorial change in the gland which would seem to indicate that the product is always abnormal. In many of these glands a portion may be normal and if a thorough examination is not made the abnormal portion may be overlooked. The most obvious changes are frequently tinctorial but nearly always there is in addition evidence of a more permanent change as manifested by round celled infiltration or changes in cell type or of proliferation of parenchymatous cells.

There is reason for believing that the tinctorial changes in the colloid are exhaustion phenomena due to overstimulation continued for prolonged periods. This statement seems warranted for we are familiar with parallel phenomena in other tissues. If this hypothesis is correct the prompt relief sometimes obtained from rest and sedative treatment is easily understood.

Whatever may be the significance of the various cell changes there can be no doubt that when cells have so far departed from their normal morphology they are no longer capable of producing a normal secretion. When a gland has undergone such extensive changes obviously the control of the factors which were responsible for the initial changes cannot be expected to produce a prompt subsidence of symptom.

We do not know the nature of the changes in the secretion but if it is the purpose of the thyroid to produce iodine then certainly the gland is in a hypo rather than in a hyper state for only a small proportion of iodine is found in the pathological as compared with the normal gland.

As a very general proposition hyperthyroidism may be regarded as a self limited disease. The manner in which the self limitation is reached must vary according to the anatomic state in which they find themselves when regression begins. A subsidence of the dominant features of the disease may not promise a return to the normal state. Most likely it is merely a spontaneous obliteration of the pathological process. Certain types it can well be understood may arrive at a state of remission with vastly less change than others. In those cases which are followed by myxedema there is a spontaneous obliteration of the entire gland. Cases are observed in which there is a curious intermixture of symptoms partly hyperthyroidism partly myxedematous. This bears out what can be easily proved by sections the fact that some part of the gland may show proliferative while another shows pronounced regressive changes. Either of these may be associated with portions of normal gland. In such cases a spontaneous or operative extirpation of the diseased part would allow the remaining unaffected portion to carry on the function in a normal manner. In those cases which recover clinically only to be followed subsequently by a relapse it is usually some other portion of the gland previously unchanged which enlarges.

That the thyroid is not equally affected has been almost wholly overlooked by surgeons. This is unfortunate for it is only when the part of the gland that is diseased is removed leaving the normal part that the surgeon can be said to have cured his patient. Careful attention must be paid to this phase before he decides on the plan of the operation. Gland in hand the surgeon should be able to say which is the diseased and which is the normal part of the gland.

In order to appreciate the degree of recovery possible spontaneously one must follow the patient for many years. I am able to determine that those cases which I saw in my

earlier practice have nearly all of them recovered or at least they cease to suffer from pronounced thyrotoxic symptoms. However while most of them at least consider themselves well there is not lacking evidence of an unbalanced somatic system. They continue to be sensitive to certain nerve stimuli or react quickly to certain kinds of physical exertion. Whether these are to be ascribed to thyroid or cardiac degeneration is another matter. Some of these have so suffered from a succession of relapses that likely there is no wholly normal gland left. Some obviously have a myocardium that is efficient only for a limited degree of exertion. Some still suffer from some other disease which antedated the primary thyroid disease and in not a few all these are complicated or overshadowed by a hereditary neurotic or neuropathic state. It is clear that in order to determine the subsequent state of our ex-patients we must examine them ourselves. A written communication from them stating that they are well is of limited importance.

As in other self limiting diseases our efforts must look therefore to the shortening of the process and in preventing a recurrence. Like appendicitis hyperthyroidism in running its cycle is subject to certain complications and accidents which must be taken into account. The fundamental factor in the treatment must balance itself against this tendency to complications. Though far simpler and more easily comprehended appendicitis has not yet reached a state where the universal understanding makes the treatment in all cases less deadly than the disease. This is vastly more apparent in the management of hyperthyroidism. In the first place the life cycle of the disease is not generally understood particularly as relates to other diseases and the difficulties and responsibilities attending surgical treatment are seldom appreciated until experience has forced them home. If spontaneous recoveries are not complete operative recoveries in certain cases are no better. This is at least true to the degree that the surgeon may feel that he is not derelict if he hesitates to operate upon all his cases of hyperthyroidism. On the contrary he is open to censure unless he carefully weighs all factors

before deciding upon any kind of operative treatment.

The following discussion is based on my own material. The purpose primarily is to determine how constantly one can predict the revelations of the laboratory from clinical examination. If this can be attained it may be possible to separate those who do not need operation and those who will not be helped by one from those we consign to operation. The case histories are given of such as will illustrate some point vital to the discussion.

In order to reach a clinical classification each patient will be considered as belonging to one of the following categories: (1) those that recover without operation; (2) those that will most likely be cured by operation; (3) those which operation would not cure but will benefit; (4) those not benefited at all by operation or in which operation is too dangerous. These are the questions the surgeon must consider before recommending operation.

In order to facilitate this discussion I shall divide the cases into several groups according to the following outline together with suggestions as to subgrouping which it seems important to note in some instances.

- I Adolescent
  - a Stable nervous system without other lesion
  - b Stable nervous system with other lesion
  - c Neurotic
- II Adult type
  - a Normal nervous state without associated disease
  - b Normal nervous state with associated disease
  - c Abnormal nervous state
- III Typical exophthalmic goiters
  - a With associated lesions
  - b Without associated lesions
  - c Localized changes in the gland
- IV Secondary
  - a With associated lesions
  - b Without associated lesions
  - c With pronounced myocardial changes
- V Atypical
  - a Acute classical hyperthyroidism
  - b Acute masked hyperthyroidism

*I The adolescent type* This group must be subdivided according to their physical state and the circumstances of their origin. The essential feature is the age of onset. Usually the patient is from 15 to 25 years of age.

a The simplest group shows evidence of intoxication after having had an innocent goiter for a period of years. The symptoms are quite parallel to those which follow the excessive absorption of the dried thyroid extract. Sometimes the symptoms of intoxication are slight. This is particularly true in girls otherwise healthy. In the former type the lessening of the labors, interdicting music and dancing for a few months for instance, together with mild sedative treatment usually produces the desired results. Some of these cases develop while simple adolescent goiter is being treated with iodine or thyroid extract. In such cases this line of treatment must be suspended and sedative treatment substituted. Those with pronounced dysmenorrhea often are rebellious to any treatment. Hydrates and iron help somewhat. Operation on either the thyroid or pelvic organs only serves to get both surgeon and patient more deeply in the mire. In some of these cases small doses of thyroid extract help both the dysmenorrhea and the thyroidism. The dose must be small and the results carefully observed. The glandular enlargement in this type is usually moderate in degree but it is bilateral. In those cases in which there is a localized enlargement, particularly if encapsulated, the results of operation are immediate and brilliant.

In this type there are few anatomic changes save a vacuolation of the colloid mass with perhaps a lessening of the basophilic characters of its colloid content. In some the cells surrounding the acini may show evidence of loosening and some show round cell infiltration and some adenoid proliferation particularly in the encapsulated forms.

CASE School teacher, age 33. The patient has always been ill. She has had a small goiter for a number of years. Three months ago when her menstrual periods became unusually scanty and since that time she has had a rapid heart. Gave her a small uniformly enlarged soft right lobe examination as normal. The right lobe was removed by operation. The major portion of the enlargement proved to

be well separated from the remainder of the gland (Fig. 1). On section it showed an increase of colloid which on microscopic examination showed distinct vacuolization with some degeneration and separation of the cells from the basement membrane (Fig. 2). The whole picture is that of degeneration there being little or no evidence of reaction. The larger portion only required removal. The result was complete and permanent recovery.

CASE Mother, age 33. This patient has had a small goiter for 7 years. She has been nervous since marriage two years ago. She had a small circumscribed enlargement in the lower pole of the right lobe, tremor and rapid heart. She improved promptly with sedative treatment but there was a tendency to relapse at times. Here operation would give brilliant results and may confidently be recommended.

CASE Schoolgirl, age 13. Her mother had dysmenorrhea as a girl and was operated on a year ago for a myoma of the uterus. The patient has always had good health. A year ago it was noticed that the neck was enlarged. This has continued to the present time. She has a moderate enlarged thyroid gland which is slightly more pronounced on the right side. The pulse is 95. She received one grain dose of thyroid extract twice a day. The gland gradually reduced in size and in six months was scarcely noticeable. She had her first menses at 10 months of age and though the flow was severe for a week she had little pain. During this time and following she was very nervous and it was noticed that the neck was again rapidly enlarged. The pulse as of today is 100 and the same tremor she is getting in her wrists and iron and the rapid heart and tremor have gradually subsided.

In this group there is no pronounced associated disease though as in these cases there is usually some event that might be ascribed as an exciting cause as in the cases above noted but they are of slight importance and their action is not great enough or sufficiently prolonged to vitiate the good prognosis.

b The second group usually more mature than those of the first group includes those in whom a goiter appears coincident with or is anticipated by some other disturbance. Perhaps they have been reduced by excessive study or a menstrual disturbance may precede by some years the thyrotoxic symptoms. These patients usually recover with the relief of the underlying conditions. The overworked schoolgirl requires rest and tonics and the dysmenorrhoeic requires appropriate treatment. This usually implies sedatives and proper living rarely operation. The underlying condition usually has existed for a



Fig. 1 The encapsulated larger portion at the top of the figure represents the diseased part

long time and frequently the condition cannot be improved for economic reasons. If there is a distinctly encapsulated adenoma operation may be done with every assurance of success. Generally speaking patients of this group usually remain labile however and a repetition of the exciting cause may precipitate a new attack. Unfortunately the recurrences may be more pronounced than the previous one and an operation may be done in the hope of breaking up the sequence. These cases occur most frequently in individuals whose reproductive functions are still in an anticipatory attitude. The thyroid bears evidence of excessive or perverted secretion rather than a direct anatomic change. Possibly this is a response from stimuli received from afar and when these stimuli cease to act the hypersecretion subsides. I have too often seen this type subside after marriage to be able to regard this as a mere coincidence. Sad awakening sometimes brings a recrudescence of symptoms. The patient returns after a few years laden with the fruits of reproduction but with a lacerated and displaced uterus. It is now the surgeon's turn to establish a readjustment.

**CASE 4.** Housekeeper age 25. Last June she began to have soreness and distress in the bowels while undergoing a considerable nervous strain. She had weak spells and was often short of breath. She has a dysmenorrhea which was becoming progressively worse. She has recently lost weight. She has a small uniformly enlarged goiter the pulse is 120 and there is a marked tremor. Under sedative treatment and rest she recovered. Two years later she complained again of dysmenorrhea and a choking sensation at those times but not at others. The pulse was 90. She quickly recovered under

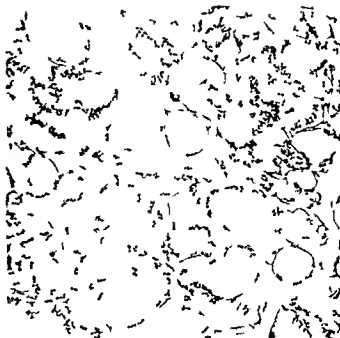


Fig. 2 The amount of colloid is increased and shows vacuolization. The cells are loosed in some parts

sedative treatment and for a year was quite well. At this time she took a severe cold during menstruation. The symptoms became much aggravated and since then have responded but slowly to general treatment. At the present time she is easily exhausted still retains some tremor and tachycardia.

The fundamental factor here is a menstrual disturbance. If this could be remedied the thyroid would be more stable.

**CASE 5.** Stenographer age 30. She has not been well for a number of years. She was nervous and sleepless and had spells of tremor. She had pain in the groins, hips and back. The flow lasted 3 to 4 days but sometimes stopped short in the midst of it and after an interruption of a day returned. The pulse was 100 to 120, tremor, the apex was diffuse and bounding. She had a moderately enlarged goiter which involved markedly the isthmus but no circumscribed nodule could be made out. The uterus was retroverted and lay deeply in the pelvis and was very tender to bimanual examination. The thyroid symptoms were always greatly exaggerated during the menstrual period.

The uterine displacement was corrected by shortening the ligaments. She slept better and the pulse decreased to 84 and she gained some weight. After numerous remissions and exacerbations a partial thyroidectomy was done with some improvement as after the operation on the ligaments. She still has her ups and downs though on the whole is better than she has been for many years. She is not quite sure whether operation has been of any great benefit. She is nervous but does not exhibit it to her friends.



Fig. 4. Thyroid enlargement in a patient with a history of goiter. The patient is shown from the front, with the thyroid gland enlarged and visible as a dark mass on the right side of the face.

c. The final group of adolescents includes those who are distinctly neurotic and whose home environment is usually bad. These patients exhibit pronounced neurotic tendencies; sometime they are even pronouncedly hysterical or are subject to epileptic seizures before the goiter is observed. It is difficult to conclude at just what point the thyroid intoxication becomes manifest. Usually a record of the pulse rate and the tremor give the best indication. These patients do badly under any treatment. Even when the thyroid involvement is well localized and the relief of the thyroid element is quite certain, there still remains the primary neurotic condition and the patient and her mother will most certainly regard the treatment as having failed if the neurotic condition persists. Usually the patient had best be assigned first to a neurologist. He may help them and at least he serve as a convenient buffer after operation which generally speaking is useless.

II. *Adult type.* In this type are included those who have attained maturity before the appearance of thyroid enlargement or if an enlargement was present during adolescence

it has been in abeyance many years. This type deserves separate consideration because expensive treatment is less hopeful as often there are associated diseases elsewhere and because of the social state of the patient operation is less objectionable. Most of them being married a scar is less objectionable than in single women.

a. *Cases previously well.* In this group we include the patient who has been healthy until the advent of the goiter. Many of these had a goiter during adolescence and the other has disappeared with or without treatment. Usually without discoverable cause nervousness and palpitation develop. Usually the degree of intoxication is not great though sometime hyperacute crises are observed. If the enlargement is confined to a sharply outlined portion of gland operation should be done. Many of these patients have associated disturbance but there is not apparent any causal connection or any interdependence. Many women naturally often show pelvic lesions of a minor sort. In this type the onset is usually gradual and the degree attained is usually not severe. Often these patients come complaining of conditions wholly irrelevant. If they can be given the requisite rest they often improve satisfactorily. Usually

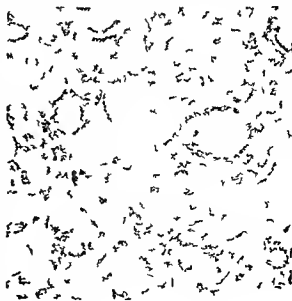


Fig. 4. Thyroid enlargement in a patient with a history of goiter. The patient is shown from the front, with the thyroid gland enlarged and visible as a dark mass on the right side of the face.

these are better treated by operation. An effort is made to remove the portion affected. This is usually done if the involved portion is strictly limited. In such cases the recovery is prompt and lasting. When one lobe only is enlarged the removal of this may secure a lasting cure. That a recrudescence of the disease may occur with the enlargement of the other lobe must always be kept in mind. In this type when there is much glandular involvement with but little signs of intoxication operation should be done.

CASE 6 Bank cashier age 37. The patient complained of general weakness, shortness of breath and nervousness. Until a year ago she had always had good health. At this time the symptoms above complained of gradually developed. She now has occasional headaches and choking spells. Menstruation has always been regular and painless. She has lost some weight. The patient has marked enlargement of the right lobe of the thyroid. She has tremor and a pulse rate of 120. The apex beat is diffuse and the sounds loud but clear. The right lobe was removed. Gross section showed a well encapsulated thyroid lobe portions of which have undergone degeneration (Fig 3). The microscopic examination showed small celled infiltration in the connective tissue, some proliferation of cells but little increase in colloid (Fig 4). The pulse after lobectomy dropped to 80 before she left the hospital. Recovery has been complete and permanent.



Fig 6 The colloid considering the character of the tissue is relatively great confusion in some places the usual picture of follicular adenoma.



Fig 5 The tumor is completely circumscribed presenting the typical appearance of a typical follicular adenoma.

CASE 7 Housekeeper age 23. She has always had good health except for some minor diseases of childhood. For several years she has noticed an enlargement of the neck. A year ago she became nervous and had attacks of palpitation. She had a moderate size uniformly enlarged thyroid moderately soft in consistency. There was no pulsation of the gland and eye signs were absent. Pulse 13. The right lobe of the gland was removed. On section an encapsulated area was discovered which was not suspected during the operation. The upper lobe was composed of large vesicles filled with colloid. The encapsulated portion showed the usual glandular type which in some areas had become infiltrated with blood. The upper portion showed a pronounced increase in the colloid material. This material did not take the basic stains but on the other hand was slightly acidophilic. It showed vesiculation in many regions. The cells were flattened in some regions there was evidence of protoplasmic degeneration and in some places the cells were loosened from the septal walls. The patient recovered quickly and has remained well.

CASE 8 Housewife age 41. She has had six children and one abortion 12 years ago. For the past six years she has had tumultuous beating of the heart whenever she becomes agitated. She sometimes has smothering spells. Despite a good appetite she is losing weight and strength. The menses are regular flows two days stops then flows again for a day. She has indefinite abdominal pain and dragging in the back. The patient has a fine tremor of the hands. The heart is not enlarged the pulse 115-140. There is a nodule the size of a turkey's egg in the isthmus. The uterus is enlarged retroflexed and tender and there is a second degree perineal laceration with rectocele. The nodule is well circumscribed and is readily shelled out. The cut surface shows a uniform granular appearance (Fig 5). The sections show a small celled infiltration in the acini and marked colloid increase (Fig 6). The pulse came down to 75 on the fifth day after operation. Recovery was complete and permanent.





Fig 7 Th l b l thm p t f m s e  
gr l pp t th t d t t ll t l m  
o c y t

b *Cases with associated organic disease*  
In those cases in which the nervous state has existed and gradually increased before the advent of thyrotoxic symptoms we must search for factors which may have caused it. If such are found they should be removed before the thyroid symptoms are combated. These patients should first of all be relieved of those things which make them nervous. Perhaps relief from the strain of housekeeping may aid in establishing an equilibrium. In another class of cases the pelvic organs are most frequently the source of the increase in nervousness. Uterine sedatives may be useful and in some cases pelvic operations may be required. Married women with pelvic symptoms resulting from childbirth furnish a large contingent to this group. A correction of the associated lesion may bring about relief or a thyroid operation may be advisable. Constitutional diseases or habits may furnish the foundation for pelvic disorders which secondarily find expression in hyperthyroidism. These cases are well worth studying for there is no question but that there is close association between the pelvic organs and the thyroid. These patients nearly all improve under rest but the improvement is not per-

manent. If the uterine trouble is pronounced and antedates the thyroid trouble it should receive attention first particularly if the goiter is small and uniformly enlarged. If circumscribed it is usually well to remove the goiter first.

CASE of Matron, age 34. She had no child 15 years ago and has had pelvic trouble since. At a pregnancy 10 years later she had albuminuria, 10 ulcers and spontaneous premature labor. Immediately following this she developed goiter and became nervous. The cervix was lacerated and eroded. The uterus was large and sensitive to pressure. The perineum also lacerated. The pelvic organs were examined and the patient placed on general treatment. She improved markedly and for ten years felt well in general except that she suffered from a rapid heart which suddenly excited her. She regarded herself as well. Just recently ten years after the operation she has missed her menses evidently the advent of the menopause and a recrudescence of all symptoms has appeared.

c *The neurotic type* This type develops an indefinite train of symptoms on a previously neurotic basis in which the underlying factor is for a long time not suspected. Suddenly a pathognomonic symptom may appear which clears up the problem. Usually it is a goiter which added to an existing tachycardia makes the diagnosis possible. Eye signs are usually absent. In cases where the observer suspects but cannot prove hyperthyroidism it may be derived because of their susceptibility to epinephrin and thyroid extract. The former gives evanescent increase of symptoms not always easy to recognize. The latter must be used with caution because its use may make the patient permanently worse.

These patients seldom have large goiters. Those who have had adolescent goiters may show considerable enlargement. They are nonpulsating and uniform in size, sometimes with the right lobe predominating. They may be small, doubt being entertained whether they are enlarged at all or not. In those cases in which a goiter has long existed it is well worth while to study carefully the patient's state before the advent of the suspected hyperthyroid symptoms. The presence of goiter may mislead one into diagnosing hyperthyroidism when the condition may be true neurotic or a positive mental

aberration with an innocent goiter. Such patients may become increasingly nervous and yet not show definite hyperthyroid symptoms. Such patients should be placed in a hospital for a week or two for observation. A pulse curve may be of importance. The pulse is prone to be more rapid in the morning. The presence of tremor is the most important sign, the two taken together warranting a presumptive diagnosis. One sometimes sees these conditions in women who have been ovariectomized. In these conditions are doubly complicated and wholly without relief by any means. One is often persistently urged to operate in the desperate hope of finding something which will relieve the afflicted patient and the long suffering family. These cases differ from the adolescent neurotic with hyperthyroidism for time usually has brought minor complications and efforts at cure have added to the original burden.

**CASE 10.** Matron age 35. The patient had one child 12 years ago and one abortion 5 years ago. Since the abortion she has had headache which extends from the nape of the neck down the spine. The headaches were so severe as to require morphine four years ago when she had nervous prostration for 4 months. She now has these headaches twice a week. She is nauseated but never vomits. At the beginning of the attack she has tenderness at the base of the brain and on the top of the head and tingling down the finger tips. The menses are regular but scant with moderate pain in the lower abdomen. The flow lasts a few days stops then starts again. The headaches are most severe at the close of the flow. She weighs 95 pounds which is much under weight. The bowels move five times a day unless controlled by an opiate. She had an operation 8 years ago for retroflexion and the right kidney was anchored 5 years ago. She has choking spells when first lying down. She sleeps indifferently despite the fact that she takes  $\frac{1}{4}$  grain of morphine per day. She says her mother always has been nervous and that she herself will always be so.

The patient greets the examiner with an I defy you to cure me expression. She is sensitive when ever touched and one instinctively touches her lightly. She has a medium sized uniformly enlarged thyroid the date of the genesis of which she does not know. It is firm and movable. There is a fine fibrillar tremor but no eye signs. The pulse is 126 the apex heart bounding and diffuse. The right kidney is movable the uterus is retroflexed tender and the cervix eroded.

The remittant menstruation and exacerbations of the headache at this time suggest an endometritis and give from the pronounced character of the

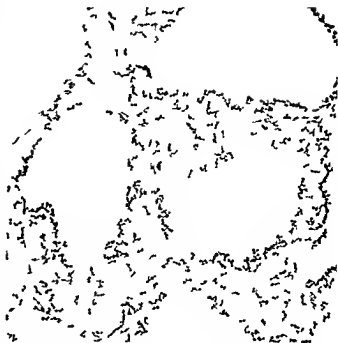


FIG. 5. The antra are all dilated and present papillary projections into their lumen. There is also extensive round cell infiltration.

neurotic symptoms would demand correction of the uterine trouble. The symptoms of thyroid intoxication should demand operation but true to her prediction she will always be a neurotic like her mother.

**III. The typical exophthalmic goiter.** In the typical exophthalmic goiters previous nervous states and associated disease of other organs seem to play a less important role than they do in the ordinary cases of thyroid intoxication. Very often there is evidence of general family degeneracy of some sort either physical or mental rather than nervous as characterizes the more simple group. Nevertheless the thyroid trouble so overshadows the associated conditions that it must receive full consideration first attention to associated lesions must be deferred until the thyrotoxicosis has subsided. Usually the patient has enjoyed a measure of health with perhaps some minor ailment up until the time of the advent of hyperthyroidism. Excessive nervous strain such as child bearing trying work at school and the like may have preceded but without any attendant nervous state. More or less suddenly the patient discovers that she has palpitation and is short of breath has tremors and may be troubled with insomnia. She discovers the neckbands



l q Th ut f b t d y  
l g t hzm h c b l d h y l d a b d y

of her dress are too small and in some instances friends may note the staring eyes. This may all take place within 1 to 6 months. Not infrequently the onset is very much more sudden often following a shock or great grief but most often without any known cause within a few days the symptoms may be present.

The subsequent course is very variable. In the hyperacute high fever and delirium appear early vomiting and rapid emaciation follow quickly and death takes place in from 2 to 6 weeks. No treatment is of avail. I have seen six of these and I have not the remotest intention of operating on such cases.

Less stormy cases are the more common. The patient develops the symptoms less quickly. There is often fever not infrequently extreme nervousness even delirium emaciation is rapid often extreme. They have acetoneuria and sometimes a dry typhoid tongue. They all differ from the group just mentioned in that after a time the delirium disappears the fever subsides and they begin to gain in weight. I tried operation on one case in the vain hope of halting her in the downward course. Never again! If treated expectantly this group usually reaches a climax then the symptoms subside and finally the patients return to normal weight. They can

then be operated on with a certainty that the road to recovery will be much expedited and relapse prevented. The time and character of the operation must be selected with care.

In some of these cases there seems to be an associated or non suppurating thyroiditis. They present the usual phenomena of excessive local tenderness to touch the feeling of heat on palpation and in extreme cases there may be slight hyperæmia of the skin. The presence of a true reaction is best appreciated when these cases are operated on. The adhesion between the gland and its capsule is such that separation can be accomplished only after the most painstaking labor and sometimes the operator is willing to compromise and remove less of the gland than he had originally planned.

The usual run of cases is less acute than the group just mentioned. They lose flesh but never have delirium and but little if any fever. As soon as the lost weight is regained or if no loss of weight occurs the patient may be operated on with a certain prospect of expediting recovery. In the milder cases operation may be done early and the development of the disease checked. Though the mortality is small there is always the risk of a stormy scene during the first day or two.



f o c h d l t t h t h p  
f t h g l d l m t

If one fears this a vessel or two may be ligated thereby anchoring the patient to him thus assuring obedience to his suggestions for subsequent treatment. That pole ligation is an innocent procedure is denied by those who have had much experience with it. The mortality even in competent hands rivals that of lobectomy. I doubt very much if this can be true when the operation is done under local anesthesia. If the patient is free from acetone and has no fever this operation may be done notwithstanding the patient is much emaciated. As to any direct benefit from the ligation *per se* one may well entertain a doubt except in those cases in which there is a strongly pulsating gland. In these the superior thyroid arteries are felt as distinct pulsating cords. Not infrequently these can be directly seen. Ligation in such cases is commonly followed by prompt gain in weight and other evidences of improvement. The superior thyroid nerve as well as the artery must be destroyed.

If one lobe only is enlarged early radical treatment is less dangerous than if both lobes are equally enlarged and success is much more certain. If both lobes are equally enlarged improvement is likely to be only partial or temporary and the patient must



Fig. 1. The cyst is now collapsed. The remainder of the gland shows small dots of colloid visible to the naked eye.

be told that further operation may be necessary. Even when one lobe only is enlarged or predominantly enlarged and the improvement is prompt and satisfactory the patient must be told that the other lobe may enlarge at some future date and require operation. If this does occur it too must be operated on. In such an event it is expedient to reoperate early unless a brief trial at sedative treatment proves promptly efficacious. When both lobes are enlarged a partial removal of both lobes may be done at one sitting but this increases the risk. For this reason I prefer to operate on one lobe at a time. The degree of risk is determined by the degree of toxicity.

In some cases with exophthalmos the enlarged part is circumscribed even encapsulated. When completely encapsulated the mass is usually situated in the isthmus less often in the lower pole of the right lobe. These represent fetal adenomata that have suddenly taken on activity of growth and obviously of secretion. In such cases the results of operation are brilliant. All symptoms save the exophthalmos vanish at once after the offending mass is removed. In the majority of cases of encapsulated goiters with intoxication however there is no exophthalmos.

The true exophthalmic cases are characterized by a true proliferation of the gland substance. Instead of there being an increase of the amount or of the multiplication of the glands in fetal adenoma there is a genuine papillary proliferation resembling that seen in serous ovarian cysts. The proliferation may be so pronounced as to mislead the unwary into



Fig. 12. The isthmus marked increase in colloid with little cell infiltration.

diagnosing malignancy. No case has yet been reported in which true malignancy was associated with exophthalmic goiter.

Finally it must be noted that the most carefully conducted operative procedures may fail to secure the desired results. Expectant treatment may rival in results those achieved by surgery but the latter under favorable conditions may secure in months what the former can attain in years. Beside surgical treatment does much to prevent relapse, cardiac degeneration and the rare but disastrous hypercute termination.

CASE. *Matro 48. Th pti tha*  
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 h l a hard l r nd s n fte h n t l th t  
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 If s much imp oved th she d n t m n i the  
 he l a h e and l a k a ch

CASE. *Labor age 30. Th pti nt has been*  
 sick thre and a h l f month He c m p l a i n s of  
 h o t n o b e t h n d v k n e s f t h k n e s  
 The t r o b l i t h h e g h s b e n o m a r k e d t h a t  
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 and l e r n e g t i e o n e x a m i n a t i o n The pul  
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 l i f f u c Ther m k e d t r e m o r Th r e a a  
 m o d e a t o p h t h l m l u t n o o t h e r c y s y m p t o m s  
 The l h l o b e a n l t h m u s e e r e m o d (Fig 1)  
 He imp o v d promptly a n l i n 2 m n t h s a b l e  
 t o d o n r m l l f o r L g h t e n m o n t h l t r t h  
 f i r s t o p e r a t i o n h e e a p p e d d i t h a e q u i t i o n f  
 h i c m p l i n t s He had l o s t o p o u n d n e w e k s  
 H h s n l a r g e d l f t l o b e e x o p h t h m o s a d a  
 v l l t e l p l c a f T h i r d o f t h e l e f t l o b e  
 w e m o d e d I n p e m t h a s b e e n s i m p t  
 a f t t h i r t o p e r a t i o n

The gl n l h o d a u f o r m t r u r h c h o n  
 s c t n f r s n t e d a p p l l a r y p o l s e a t o n l t h  
 e p t h l m (Fig 2) Th gland sho s the t y p c a l

m c r o s c o p i c p i c t u r e f t h e o p h t h a l m i c t y p e The  
 e x s i g n s o b v i o u s l y a r e d e p e n d e n t o n a c e r t a i n t y p e  
 o f g l a n d c h a n g e

IV. *Secondary hyperthyroidism* In this group may be included the patients who have long had an innocent goiter annoying only because of its disfiguring effect. These patients are normal in every way at least are not conscious of nerve. They are seen most frequently in women at or past middle life. Gradually they develop dyspnea at first perhaps ascribed to pressure from the enlarged gland then come rapid heart and tremor. They rarely have eye signs. This type is apt to have dilated hearts. It is not easy to distinguish the rapid heart of degeneration from that of intoxication. Generally speaking the toxic heart is most rapid in the morning even when the patient is kept in bed while in myocardial degeneration rapidly increases with exertion. Often in the latter direct evidence of myocardial degeneration may be discovered. Myocardial degeneration may antedate the other symptoms of toxic goiter. The innocent goiter apparently gradually destroys the heart muscle before the symptoms of intoxication appear. At any rate serious myocardial degeneration appears earlier than after the other forms of the disease. The importance of an exact differentiation is found in the fact that a myocardial degeneration does not disappear after the subsidence of toxic symptoms. Furthermore patients who have myocardial disease and subsequently develop toxic symptoms usually die soon from progressive myocardial weakening no matter what the treatment.

On the other hand the patient with the cardiac symptom even with considerable dilatation but without much change in the heart muscle itself when the offending thyroid is dealt with recovers promptly. Generally speaking symptoms of hyperthyroidism are relieved by operation in proportion to the degree of localization of the process. In adenoma the symptoms disappear at once including the cardiac hurry. Fortunately often these patients have had one lobe predominantly enlarged so that it is possible to get rid of most of the affected portion by operation. This type should be operated on early. Not

infrequently these patients have marked pelvic disturbances but the cure of the pelvic lesion has no effect on the goiter. My practice in these cases is to do the pelvic operation first under ether and the goiter a week later under local anesthesia. I am perfectly willing to give these patients ether for the pelvic operation but not for the goiter operation. In this way the patient can have both conditions relieved by the stay of two or three weeks in the hospital.

In structure these goiters are colloidal and differ from classical colloids only by the change in staining reaction, vascularization and sometimes round celled infiltration. It is important to note that usually but a small part of the gland is involved and unless the examiner is persistent the affected portion may be overlooked. These never show much gland proliferation and never papillary formation. This fact accounts for the absence of eye symptoms.

Goiters which exist for a long time are not innocent unless they have become calcified. Unless they do become calcified while they may not become toxic or undergo malignancy they may have a deleterious effect on the heart muscle. How much we may do toward preventing these changes by operation is dependent on how much of the offending portion of the gland we may be able to remove.

**CASE 13.** Matron age 55. The patient has had three children, no miscarriages and had passed the menopause two years ago. For several years prior to passing the menopause the menstrual flow was irregular and excessive. She has had a goiter for 30 years. It grew slowly until 4 years ago but since that time it has not grown. Since the menopause she has had nervous spells and palpitation. The goiter seemed sensitive at times and seemed to disturb her respiration. Her sleep has been somewhat disturbed. There was a moderate fine tremor. The thyroid isthmus showed a mass as large as a goose egg (Fig 9) and a smaller nodule in the upper pole of the right lobe. The pulse was 86. The nodule was removed. The disturbance to respiration seemed the only certain indication. The removal of the nodule resulted in the prompt and complete subsidence of all complaints.

It seems fair to assume therefore that the part removed was exerting a mild intoxication. This gland bears out the assumption that when a gland long existent produces

symptoms it is due to an increased colloidal secretion and not to proliferation (Fig 10). It is due to this fact likely that improvement is so prompt and lasting after operation.

**CASE 14.** Matron age 36. She has had enlarged thyroid for many years. She was never conscious of any disturbance from it. A year ago she became nervous and tremulous. Examination shows the pulse 100. She has a marked tremor and has lost a little in weight but feels weak out of proportion to the amount of weight lost. A right lobectomy was done. She left the hospital on the fifth day with a pulse of 80. She was completely relieved of all symptoms. The specimen showed a cyst as large as a small apple in the upper lobe. The section showed cellular activity and marked increase of colloid.

This type shows less prompt and lasting recovery than the preceding one.

**CASE 15.** Widow age 53. She had one child 5 years ago and passed the menopause 5 years ago. She first noticed her goiter 18 years ago. A year ago she had pain in it for the first time. Since this she has had difficulty in going to sleep. She is exceedingly nervous and worries a great deal though according to her own statement she has nothing to worry about. She has night sweats and has lost considerable weight. The pulse is 96 and there is marked tremor of the hands. There is a well circumscribed tumor the size of a small apple in the isthmus. The tumor was removed. The pulse dropped to 66 before she left the hospital and her other symptoms were relieved. The tumor contains several cavities filled with straw colored fluid. The remainder is whitish pink and granular. On section this is seen to be adenoid tissue.

**V Atypical.** In this group those cases may be placed which because of their course or form depart widely from the usual. One may observe them many months even years before a definite diagnosis is possible. They may present the general symptoms of a neurotic. The one dependable clue is that they lose weight, regain it and lose it again. A typical neurotic does not do this. The toxic cases likewise when placed in bed often show a high morning pulse with a lower one in the evening though at no time is the pulse high enough to designate it as tachycardia. For instance a patient may show a pulse of 80 at a number of examinations but if placed in bed the nurse may find the pulse 90 to 95 in the morning hours before it is time for the doctor to make his rounds. If in addition to

thus there is tremor the diagnosis is strongly presumptive. Often in such cases a thyroid enlargement or eye signs may reward the astute observer for his pains. Operation does these no good but they recover unless a too doting family thoroughly convert them to the joys of invalidism. This type is often operated and reoperated on without noteworthy results. Everything about them is defective and one cannot make a plus by taking still more away from a minus. In these more than any other type one must study the state of the patient before she became sick.

In another group small fortunately an exact diagnosis may never be possible. The small hard thyroid possibly existent for many years may be palpated perhaps if it is sought for. The patient may be a confirmed neurotic presenting a complete picture of a neurosis. Often if one searches the past history he may receive a clue. True neurotics are congenitally introspective and selfish. If in the absence of such a history the general symptoms of an indefinite neurosis develops the possibility of an endocrinal disarrangement must be kept in mind.

CASE 6 Baker age 5. The patient has 14 years had good health until 5 weeks ago. Without known cause he began to feel worn out and had palpitation of the heart. The palpitation was made worse by excitement rather than by exertion. His sleep has been much disturbed by the nervousness. When he entered the hospital he had a pulse of 106 temperature 100 respiration 30. The lungs and abdomen were negative. The apex was outside of the nipple line and was diffuse. The right border was near the midline of the sternum. The mitral sound was somewhat muffled but there were no

mur-murs. The leucocyte count was 9000. Because of the persistent low fever and the heart findings a probable diagnosis of endocarditis was made. The significance of an apprehensive nervousness was entirely overlooked. Rest in bed for several months was attended by general improvement. He returned in two months in much the same condition as on his first entrance. He had at this time Kocher and Stellwag signs rendering the diagnosis easy. A month later the right lobe of the thyroid was found to be enlarged. This enlargement remained apparent for six weeks then gradually disappeared. The disappearance instead of being attended by improvement was followed by an increase in the nervousness amounting to actual mental disturbance at times. He subsequently improved and returned home. Here he had a rather sudden exacerbation and died.

In approaching the study of the therapeutic effects of goiter it is helpful to have observed cases untreated in order to obtain a knowledge of the life history of the disease. If one has not had this opportunity it may be obtained in a measure by reading the earlier literature. The young man is too apt to assume that whatever good follows his efforts must have come because of such efforts and if disaster is averted it must be because of his efforts.

It should be ever kept in mind that the general tendency is toward recovery and that many do recover spontaneously. Recovery may be expedited by judicious operations. The time for operation must be carefully selected and the operation chosen must be commensurate with the resistance of the patient. Above all the operator must ever hold the fact before himself that his operations must be without mortality lest his therapeutic endeavors prove a greater menace than the disease.

THE SURGICAL TREATMENT OF EXOPHTHALMIC AND THYROTOXIC GOITER WITH SPECIAL REFERENCE TO BILATERAL RESECTION<sup>1</sup>

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THERE is no subject in the category of medicine about which there is so much diversity of opinion between internist and surgeon as there is in the treatment of exophthalmic goiter. There is moreover no uniformity in procedure as to operative indications and operative technique among surgeons themselves. The whole subject seems to be in a chaotic state and this no doubt is due to the fact that the actual etiology of the disease is still unknown.

McCarrn (1) says: "There is no definite proof that the cures effected by surgical means (that is by hemi thyroidectomy alone or with ligation of arteries) are more lasting than those effected by medical means." He has done excellent work on diseases of the thyroid and has pointed out the importance of searching for focal infections but without minimizing the importance of these infective foci as etiological factors of obscure diseases. However often one finds that even after all are removed these cases are not cured and conversely it is seldom that one finds associated with extreme oval sepsis infected gall bladders and appendices or profound intestinal stasis exophthalmic goiter.

Medical treatment in Graves' disease has not been eminently successful. Thus Sattler (2) estimates the mortality at 11 per cent. In Hector McKenzie's (3) experience the mortality has been about 25 per cent and others report as high as 30 per cent. The large percentage of uncured cases from medical treatment is also discouraging. Kuttner (4) traced 9 patients who had been under medical treatment for 15 years but not one had recovered health. In Osler's *System of Medicine* the statement is made that it is a disease from which few recover and some die.

While medical treatment has made little advancement surgical treatment has progressed steadily. Osler (5) says that removal of the thyroid gland offers the best hope of permanent cure and quotes the statistics of

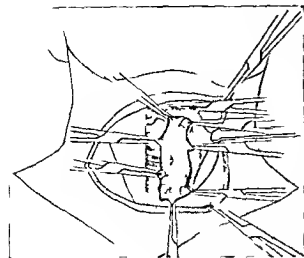
Kocher and the Mayo's giving the operative mortality below 4 per cent and cures of some 70 per cent. Torchheimer (6) while stating that the physician who recommends operation in Graves' disease should at least have exhausted all other means of treatment says that operative procedure on the thyroid gland is a logical and scientific mode of treatment is fully admitted.

It must be admitted that there is a certain percentage of cases that are cured and remain cured by medical treatment alone. Thus we have Hale White's (7) analysis of 100 hospital and private cases investigated over a period of 20 years 10 of which were traced and of these he gave the cures at about 50 per cent. This leaves a margin of uncured who finally look to surgery for relief.

Among surgeons there is no unanimity of opinion regarding the surgical procedure. Thus Rogers (8) claims 70 per cent cures from ligation of the four thyroid arteries. Walton (9) says that hemi thyroidectomy is the operation of choice. Others as Kocher the Mayo's and Ochsner do a lobectomy with or without partial resection of the remaining lobe. Donald C. Balfour (10) in pointing out the advantages of bilateral resection in simple goiter says its field of usefulness is very limited in the exophthalmic type while Halsted (11) advocates bilateral resection as the method of choice with or without preliminary ligation of one or more arteries as the case might indicate.

Since 1911 I have done bilateral resection on 31 cases of true Graves' disease or cases with positive symptoms of hyperthyroidism where both lobes of the thyroid were enlarged. All cases operated upon that did not have definite tremor and tachycardia have been excluded. There was no operative mortality in this series. My operative mortality for goiters of all types was one. This was one of my earlier cases of Graves' disease in which a single lobe was resected. It was done before the patient had sufficiently recovered from





Fg Sh w g l mp ppl d t th ve l n th  
ps l d th p t f gl d l fr t f them c t aw y  
Th c t l ry g l rve h n the d w g  
but doe t m t i i th pe t n

an exacerbation of symptoms. One other case died following an injection of boiling water into the gland. This was an extremely severe type of the disease.

The patient was a young girl and had been ill over five months. She had an enormous appetite, marked tremor, pulse rate 50 to 60 per minute and flushed skin. After three months absolute rest in bed and expert medical care under two of the best internists, improvement was very slight. Ten cubic centimeters of boiling water were injected into each lobe of the gland. In the afternoon patient, as vomiting, pulse rate increased and on the third day the heart began to fibrillate and she passed away on the fourth day.

Preparatory treatment such as absolute rest and medical care preceded every operation and in some injections of boiling water into the gland as advised by Miles Porter (12) followed by ligation of vessels. In a few cases after prolonged rest when the toxæmia seemed to be well controlled, bilateral resection was done without preliminary ligation. In some of my earlier cases a unilateral resection was done and the remaining lobe dealt with later when relief was found to be incomplete. Two of my cases operated on in this way some years ago and who were not completely relieved have not returned for second operation—although advised to do so—and I still think that in certain mild cases especially

where the enlargement of the thyroid is asymmetrical the first operation should be limited to one side. This rule I think can be laid down as absolute in those thyrotoxic goiters associated with adenoma or cyst of one lobe. In most of my later cases with well marked symptoms who have gone through one or more severe exacerbations of toxæmia, bilateral resection was done at one operation. This has been more satisfactory, the cure more positive and the patient saved the annoyance and inconvenience of undergoing a second operation.

Halsted (11) says that in several instances in which the ligation of three arteries plus the excision of one lobe has been attended with almost negative results, relief from all symptoms followed immediately upon removal of most of the remaining lobe.

It is frequently asserted that as a result of operation a condition of myxœdema may follow as an early or late sequela. But as Dunhill (13) says the operation is being performed extensively and many critical eyes are watching results and any cases occurring could scarcely escape observation. Personally I have never seen such a result. To my knowledge no report of a case has as yet been recorded in the literature nor do I know of a case being presented at a medical meeting. Conversely, cases are reported and I have operated on such where sufficient gland had not been removed. McCarnson (14) records one case having recrudescence of symptoms after operation but does not state the type of operation done. It is obvious from the picture shown that an enlarged lobe still remains.

In estimating the amount of gland to be left for functional purposes I have been guided by the research work of the University of Minnesota where it has been found that one sixteenth of the gland is necessary in the adult and one third in the growing animal. This however applies to normal gland while clinically patients with exophthalmic goiter seem to do well when very little of the thyroid remains. In severe cases I have aimed at leaving the minimum amount of one sixteenth of the gland but in some of the less severe types somewhat more than one sixth has been left. Many of the cases here recorded have been



Fig 2 Both lobes resected and the portion of the gland left dropped back beside the trachea leaving the neck symmetrical

observed over a number of years but not the slightest sign of myxœdema or hypothyroidism has been noted in any of them

In cases of Graves disease without obvious enlargement of the thyroid the change from the normal is more microscopic than macroscopic in other words although the gland is not visibly enlarged it has the same histologic characteristics as in the cases where there is obvious enlargement. It has the same solid fleshy appearance in gross section and microscopically shows hyperplasia of the cellular elements. The treatment in these cases should therefore differ in no way from those where definite enlargement is present and one cannot see why Dunhill (15) advises against operating on them. He suggests that the cells are so closely packed that they will die from mutual pressure and that the gland will later atrophy.

One of my cases was diagnosed exophthalmic goiter though the eyes were not unduly prominent and absolutely no enlargement of the thyroid could be made out. There was tachycardia and tremor for several months. Six months later the thyroid was distinctly larger than normal. She had a successful resection of both lobes in two stages. I saw

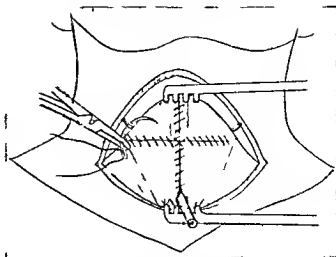


Fig 3 Infrahyoid muscles sutured and tube inserted at the lower angle. When the tube is brought out through a separate stab incision a very noticeable scar remains. It is best brought out through the incision made and the resulting scar is easily covered by a small necklace.

this patient 2 years later and her general health was good although she was a sufferer from chronic pelvic trouble.

Though many of the cases presented themselves in a condition of pronounced toxæmia few were so severe that with rest they were not sufficiently improved later to undergo operation. Two cases were practically moribund when first seen by me. One had declined operation of any sort some time before and died from the disease a few days later and the other died the day after admittance to hospital. It cannot be emphasized too strongly that the time to operate may not be when the case first presents itself. In one instance the patient reacted so severely to injections of boiling water that operation was not considered until several months later when a preliminary ligation of the inferior thyroid under local anaesthesia was done and both lobes resected two weeks later. In neither of these operations was there any reaction compared with that following the injection of boiling water.

One case was certified insane and on his way to an asylum when his real condition was recognized by Dr J E Coulter who asked me to see him. We did a preliminary ligation of both superior thyroid arteries and two weeks later bilateral resection. Recovery both mental and physical was rapid and complete.

He returned to his farm and has been able to do his normal amount of work for over two years.

Another case had a ligation of the right inferior thyroid under local anesthesia. There was such marked reaction that no further operation was advised until she had at least three months longer rest. She improved so markedly in that time and seemed so perfectly well that no further operation was advised for the present. This case does not therefore belong to the series here recorded but no doubt would have had her symptoms persisted and may yet should they return. As the thyroid is not a functionless organ like the appendix we cannot conscientiously advise its removal after its first offense.

One of the advantages of ligating the inferior thyroid over the superior is that the incision is in the same line as that for resection. Its chief disadvantage is that the operation is more difficult.

#### TREATMENT

All treatment to be rational should be based on pathology. The surgical treatment of exophthalmic goiter is based on the theory of thyroidal auto-intoxication. Murray (15) says:

We do not as yet know the actual exciting cause of the special proliferative changes which are found in the thyroid gland in exophthalmic goiter. Whether further research should prove exophthalmic goiter to be a hypersecretion or an altered secretion of the thyroid or only one phase of a complex disturbance of the functions of other ductless glands, one fact remains that the thyroid is never found normal microscopically in cases showing the symptoms of exophthalmic goiter (Kocher 16, Berry 17) and that removal of the gland gives positive beneficial results which results are often in direct ratio to the amount of gland removed.

Even the extreme advocates of the new theories ascribe the chief role in this disease to increased activity of the thyroid. If we accept the foregoing why then are so many physicians opposed to surgical treatment? The reasons seem to be the former high mortality following operation, failure of complete cure from inadequate operation, and the fact that a number are apparently cured by medical treatment alone.

*Indications for operation.* Have we exact indications as to when or at what stage operation should be undertaken?

Recognizing that there is an ebb and flow in the symptoms of exophthalmic goiter it is most important to time the operation to the stage of remission and not during the acute exacerbation. No doubt in the past the high mortality from operation in Graves' disease was due to the fact that cases came to the surgeon at the height of the paroxysm. Sufficient stress has not been laid on the time at which operation should be undertaken. Plummer (18) says that the time to operate is early in the attack or late when symptoms have passed the crisis. I have had no personal experience with operating early in the attack and it seems to me that more statistics should be available before one could say that operation was as safe then as it is when the attack has subsided. In all my crises I have employed rest and medical treatment until the acute stage had passed. No matter how severe the case the first line of treatment should be absolute mental and physical rest combined with medical care and the severer the symptoms the stronger should be the adherence to this rule. I would like to emphasize the fact that I consider exophthalmic goiter should never be considered a surgical emergency.

As already mentioned medical statistics show that probably 50 per cent of cases recover entirely without the aid of surgery. Therefore it would seem that in the first stage surgical treatment should not be considered but medical treatment employed and operation only undertaken should the symptoms again recur or persist for a prolonged period. Again were the first attack an unusually severe one it would be justifiable to consider operation after it had subsided.

Undoubtedly there are cases that do not show this typical rise and fall of symptoms but run a more or less continuous course and these should be operated upon. One must bear in mind that continued thyroid intoxication tends toward organic changes in the heart and other organs and if this be allowed to progress indefinitely the damage done will be permanent. Surgery will arrest further dam-

age to these organs by reducing the output of toxins but cannot repair damage that has already been done Landstroem (19) has drawn attention to this fact

*Contra indications to immediate operation*  
Operations should certainly not be undertaken in those acute fulminating cases which Osler describes and in which Schlesinger (20) has pointed out the high mortality following operations

Operation should certainly not be undertaken during the recent onset of acute intoxication in any stage of the disease

In cases of organic disease of the heart the patient should first be under the care of an internist expert in the diagnosis and treatment of cardiac conditions

#### OPERATION

A factor of great importance in the operation is the anæsthetic Almost every anæsthetic—general and local—has been used but the one which seems rationally indicated is a combination of nitrous oxide and oxygen together with anocaine and adrenalin as local infiltration It is to Crile that we are indebted for this development in anæsthetics which aims at reducing to a minimum the element of shock

A transverse incision 2.5 or 3 inches long and a finger's breadth above the sternum is made through the skin and platysma The anterior jugular veins are divided between artery forceps and a flap of skin and platysma is dissected upward The infrahyoid muscles are next separated along the mid line and retracted laterally If retraction alone does not admit of a sufficient exposure of the gland the sternohyoid and sternothyroid muscles are divided transversely

One lateral lobe is now freed by blunt dissection or with the finger and lifted into view The superior thyroid vessels are caught where they enter the gland at the upper pole and are divided between forceps The lateral lobe can now be pulled forward and several clamps applied to the large vessels as they are seen crossing the capsule of the gland in an anteroposterior direction These clamps are applied just posterior to the line where the section of the lobe is to be made and

necessarily one has in mind when applying them the amount of gland to be left for the purposes of thyroid function When all vessels in the capsule have been clamped in this manner that part of the lobe in front of the clamps is now removed with the knife leaving the posterior part of the capsule and a small portion of gland in front of it (Fig. 1)

The isthmus may now be divided or left continuous with the detached portion of the lobe and the opposite lobe dealt with in a similar manner to the first One or two small branches of the inferior thyroid artery in the substance of the gland may require ligation but it is remarkable how little bleeding there is from the actual gland substance when all the vessels in the capsules have been carefully caught before section is made Should oozing continue after all clamped points have been tied the divided edges of the capsules may be sewn from side to side over the raw surface It will be seen that no attempt has been made to secure the inferior thyroid artery before it has entered the gland substance This is not only an unnecessary procedure but one to be avoided so that the circulation to the remaining portion of gland and parathyroids shall be preserved Furthermore this eliminates all possibility of injury to the recurrent laryngeal nerve which does not come into view in any stage of this operation The two remaining portions of the gland are allowed to fall back into the recesses on each side of trachea (Fig. 2)

The divided ends of the infrahyoid muscles are approximated with catgut sutures and a drainage tube inserted between these muscles down to the gland The anterior jugular veins are surrounded with catgut stitches and tied on the deep surface of the flap some distance from the edges (Fig. 3)

The flaps are next secured by two sutures of silkworm gut The first is passed through the skin and runs as a continuous stitch uniting the edges of the divided platysma then out through the skin again the second is a Halsted intradermic stitch uniting the divided edges of the skin Thus no catgut remains near the suture line and the sutures of silkworm gut which close the incision are later completely removed By this method an almost invisible scar is obtained

## ADVANTAGES

The advantages of bilateral resection over unilateral lobectomy or unilateral lobectomy with partial resection of the opposite lobe are

1 Minimum injury to the parathyroids

Absolute safety for the recurrent laryngeal nerve

3 If for any reason further removal of gland should be indicated such as for recrudescence of symptoms of thyrotoxic activity or the rare but possible occurrence of malignancy the one side could now be completely removed with an assurance that some portion of gland remained

4 It is a physiological fact that where there are paired organs should one be removed the other undergoes hypertrophy. Thus while desirable in a condition where one is normal is what we wish to avoid in the case under discussion and this end is best obtained by double resection

5 Finally for cosmetic purposes in the operation of lobectomy there is a well marked depression on the side from which the lobe has been removed and on the other side the portion of gland left produces an undue prominence while in bilateral resection the neck is obviously symmetrical

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## LARGE VESICAL CALCULI

REPORT OF A CASE<sup>1</sup>

By F. MERSON C. SMITH M.D. MONTREAL QUEBEC

H. U. L. G. I. R. S. I. V. I. H. P. I.

**O**BSERVATIONS and descriptions of vesical calculi are found in the earliest medical literature. Perineal lithotomy introduced by Frere Jacques in the middle ages remained the greatest surgical operation up to the development of modern surgery.

New methods of diagnosis and operative treatment have been greatly developed in the last 25 years so that the smallest stones which escaped detection and the larger stones which had such a high rate of mortality following operation can now be more surely and safely diagnosed and treated.

The exceptional case which forms the subject of this communication was treated in the Urological Service Royal Victoria Hospital during the last year. The following is a summary of the clinical record.

Patient A. S. farmer age 35 was admitted on February 1, 1918 (Case No. 588 002 6). He complained of frequent and painful urination. The history obtained was that about 20 years ago he had a severe attack of abdominal pain accompanied by hæmaturia. This attack lasted several days and never recurred. Since that time he has voided blood about once a year but only after being shaken up. Five years ago there was retention of urine for a short time. Since then he has had difficulty in starting urinary stream and urination has been accompanied and followed by scalding pain. There was constant tenderness in the bladder region which was worse while he was up and about. During the last month these symptoms have become aggravated. The frequency which before had occurred every one and a half hours during the night became half hourly. The suprapubic tenderness was more marked and the pains after urination lasted 5 to 10 minutes. No hæmaturia has been present since the fall of 1917. No urethral discharge no calculi passed. The urine of late has been cloudy and ammoniacal.

*Personal history.* The patient had measles in childhood whooping cough at the age of fourteen the grippe for three consecutive winters 1912-1914. He has had hemorrhoids for 10 years. He uses alcohol at times to excess. He smokes heavily. He denies having had gonorrhœa or syphilis.

His family history is negative for tuberculosis cancer or lues.

Physical examination shows a fairly well nourished well developed man 6 feet in height. He is somewhat dull and rather phlegmatic. He lies in the dorsal decubitus in no apparent pain or distress. He can assume other positions with ease. The skin and mucous membranes are of a good color. His temperature is 97, his pulse 96 and respiration 24.

The lymphatic system shows no generalized enlargement. The thyroid is normal.

The respiratory system shows no pathology save a moderate degree of emphysema.

Examination of the cardiovascular system shows the pulse rate 90 regular and of good volume. The blood pressure systolic 148 diastolic 11. The vessel walls are moderately sclerosed. The heart shows a normal area of cardiac dullness. Sounds at apex and base are clear and distinct. No murmurs.

The teeth are poorly preserved with moderate pyorrhœa of the upper and lower gums. The tongue is moist and slightly coated in the center. The abdomen is flat and symmetrical and moves freely with respiration. There is tenderness in the suprapubic region. No masses or organs can be palpated. There is no free fluid.

The skin and extremities show no abnormalities.

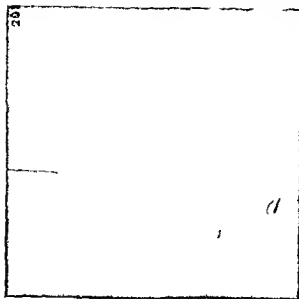
Examination of the nervous system shows that the pupils are equal and active to light and accommodation. Superficial and deep reflexes are present. Sensation is normal. There are no pathological reflexes.

Examination of the genito-urinary system discloses no tenderness in the costovertebral angle on the right or left side. No tenderness along the course of the ureters. The kidneys were not palpated. On the slightest pressure over the suprapubic region there is tenderness. An indefinite mass is palpated filling the bony pelvis. The penis shows redundant foreskin no scars. The scrotum and contents are normal.

Rectal examination reveals in the prostatic region a large mass of bony hardness which is absolutely immovable. Bimanual examination discloses a mass between the rectal and suprapubic hand. The urethra would not admit a No. 1 French rubber catheter meeting obstruction at the apex of the prostate.

The urine is cloudy straw colored alkaline specific gravity 1.018 and negative as to albumin and sugar.

Microscopic examination shows pus +++ epithelial cells few red blood cells.



I g R t a m h g h d f l l

The next day I discovered that the patient was  
sharply and the X-ray plate (No. 648)  
showed a large shadow filling the tube and  
extending up into the bladder. It resembled a junction  
of the fallopian tube.

On October 2, I made a cystoscopic  
examination of the bladder.

A phenolphthalein intramural test  
showed a latent kidney infection. The amount  
of infection was per cent for each hour 5  
percent total; i.e., 25 percent.

On October 11, I gave Dr. M. A. K.  
a stone filling the bladder palpated. The prostate  
neum was enlarged in the middle of the bladder  
to the trigone. The bladder was full of the stone.  
The stone was immovable but slightly  
movable in the pelvis. With difficulty it was  
removed. It was a large stone, 1.5 cm. in diameter,  
with a rough, irregular surface. The bladder  
muscle was not bled. The stone was removed.  
The stone was a large, dark, rough, irregular  
stone. The stone was removed.

During the first week the temperature ranged  
between 37.5 and 38.5 with the pulse from 80 to 100.  
Then the temperature dropped to 37.5 and the pulse  
to 80. The bladder was irrigated daily and a  
urethral catheter kept the patient comfortable.

On April 1, I made a cystoscopic examination. In  
strum was easily introduced through a normal  
urethra. The urethra was free from any obstruction  
and the stone was a large, dark, rough, irregular  
stone. The stone was removed through the  
urethra.

On April 8, under nitrous oxide gas the wound  
was opened, the small calculus was removed and  
the debris washed out. A suprapubic tube was  
inserted with siphon drainage. From then the con-  
valescence was uneventful save for a right epidid-  
ymitis in a week. The wound closed except for a  
pinpoint sinus which opened at interval.

On July 1, the patient was cystoscoped previous to  
discharge. The report states: Bladder mucosa  
much improved since previous examination. Some  
redness of the bladder easily washed out. There is a  
pinpoint sinus at the site of the suprapubic wound.

On July 4, discharge. The general condition of  
the patient as excellent. The pinpoint sinus does  
not depend on infection. The catheters had per-  
formed their duty.

The patient was readmitted on September 22  
with a suprapubic sinus from the bladder.  
On September 6, he was operated upon. The sinus  
was dissected out and the bladder freed. A cal-  
culus was found at the neck of the bladder. A  
removal of the calculus was followed with catheter in  
the urethra.

Discharge December 5, with sinus closed. Gen-  
eral condition normal.

Discharge of calculus. The calculus weighed  
38 grains (1.5 gram) in the moist state. This  
did not include any of the flask and fragments  
which remained during the removal. It was a  
hard, white, brittle, the total weight up to 40  
grains. It was a light brown color, smooth  
on the outside. It was a reddish white color  
on the inside. The weight of the calculus was 36 grains (Fig. 1).

The calculus was a large, white, brittle, the  
total weight up to 40 grains. It was a light brown  
color, smooth on the outside. It was a reddish  
white color on the inside. The weight of the cal-  
culus was 36 grains (Fig. 1).

Chemical analysis showed that the calculus was  
composed of calcium phosphate. The ureters were  
dominated by this material.

Urinary calculi may originate in the bladder  
or may start in the kidney and pass down-  
ward and there grow by accretion. They are  
found by far the commonest in old men and  
young children. In women they are rare on  
account of the short and relatively large  
urethra and the rarity of residual urine.

Recent investigations with application of  
the principles of colloid chemistry to the  
formation of urinary calculi, although su-  
perfluous of the actual cause of lithogenesis, as  
yet fail to elucidate the primary impetus for  
the beginning of these structures in the human  
body as well as the reason for the increase in  
size and the variable form and density of the  
individual substances.

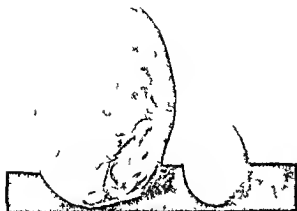


Fig. 1. Calculus with hen's egg for comparison.



Fig. 3. Cross section of calculus.

Schlagentweit (1) in a review of 36 vesical calculi found that 16 were formed in the kidney, namely 212 urates and 4 phosphates. Two thirds of these vesical calculi had accordingly originated in the kidney, the remaining third evidently having originated in the bladder, namely 44 urates and 66 phosphates, total 110. Some of these 44 urates which originated in the bladder may possibly have been derived from the kidney, although this could not be positively demonstrated. In the case of 70 phosphates it is certain, however, that 66 of these were formed in the bladder, namely secondarily through fermentation in the ordinary way. Only four of the phosphates (as compared to 21 urates) had come down from the kidney. As a marked distinction from the urates, vesical phosphatic calculi are secondary and form in the bladder itself in about 92 per cent of the cases. In a general way the kidney must be considered as the source of most vesical calculi, phosphates originating almost solely secondarily in the bladder itself. The rapidity of formation and the rate of growth of the calculi are very variable. Whereas phosphates will form very rapidly around a foreign body, other calculi may increase in size only very gradually. Large stones are always of a mixed composition.

In a careful bibliographical investigation we could find no report of as large a calculus as in our case, which had been successfully removed entire with complete recovery of the patient.

The large vesical calculi reported may be divided into three classes: (1) calculi found at autopsy; (2) calculi removed with subsequent death of patient; (3) calculi removed with recovery of patient. In the first class are recorded several interesting cases.

*A* Specimen No. 83 from the Dupuytren Museum. It weighs 53.305 ounces and was found in 1690 at an autopsy performed in the Charité Hospital, Paris. The patient died at the age of 47 and had suffered with symptoms referable to vesical calculus since the age of 7.

*B* Langenbuch (2) reports a case which had been under his observation. An operation was considered inadvisable. The patient died and at autopsy a bladder stone 5.4 ounces in weight was present. It had a nucleus composed of uric acid.

In the second class the recorded cases are more numerous.

*A* The largest calculus that we discovered was in a case operated upon by Cline, as referred to in Watson and Cunningham's *Genito-Urinary Diseases* (3). It weighed 46 ounces. The patient did not recover.

*B* Two calculi are reported, each of which weighed 44 ounces. The first of these was a case in 1801 in London, England, by an unknown operator who had to leave his task unfinished on account of the patient's condition. The patient ultimately died. The calculus is preserved in the Hunterian Museum. In the second case, Lark (4) attempted to remove the stone by the perineal route. Only a portion of it was obtained and the patient died ten days later. At autopsy the stone was found to weigh 44 ounces.

In Ashurst's *International Encyclopedia of Surgery*, four cases are referred to of calculi weighing 40.5 ounces (Utterhøwen), 32 ounces (Dupres), 31





# UTERUS BICORNIS UNICOLLIS WITH TWO OVA IMPLANTED IN ONE HORN AND A FIBROID IN THE OTHER<sup>1</sup>

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D. p. r. t. f. Anat. m. y. U. n. s. y. f. Ch. g.

**U**TERUS bicornis unicollis is not such a rare condition that a report of the usual case would be of interest. The present case is given because of the mistake in diagnosis and the unusual pathology present.

Mrs. L. F., age 36, came to the Chicago Lying In Hospital May 11, 1918, with the following history. She had had a cold beginning four weeks ago at which time she coughed considerably and had pains in the chest with chills and fever. She was in bed for three weeks. During the past two months she had had colic like pains in both lower quadrants of the abdomen. They had been worse in the left side and on exertion. She had had pains during her cold and on May 7, after washing clothes, she felt sick with pains in the sides which gradually grew worse. There was also burning pain in the back. On the 8th she noticed a bloody vaginal discharge and was told by the physician to remain in bed. The bloody discharge stopped on the 9th. When she walked she felt very heavy in the vaginal region and as if everything were pressing out. When she entered the hospital she complained of severe pain in the lower abdomen, especially on the left side. There had been no acute attack of pain. When she was quiet in bed the pain was much better.

**Family history.** Father living and well. Mother had pulmonary tuberculosis. Three brothers living and well. Four sisters living and well.

**Previous illnesses.** She had had scarlet fever in childhood. She had had no operations nor abscessed teeth. She had had convulsions shortly after marriage.

**Menstrual history.** Menstruation began at 13, was regular, 7 day type, painful and profuse.

**Obstetric history.** The patient was married at 18 and had her first baby at 19. She felt bad during pregnancy. Delivery was instrumental and the baby died on the third day. The cause of death was unknown, although she stated it vomited blood. The second baby was born at 20. Delivery was instrumental but the baby lived. Following this she had a spontaneous miscarriage at three months. When she was 23 her next child was born and this was instrumental and the child lived to be 11 years of age. Her next child was born at 6, spontaneous delivery, and the child is now 10 years old.

Her last period was March 10, 1918, at which time she flowed profusely. She has not been preg-

nant for 10 years, during which time she has not felt well inside. No one advised her that she had an abnormal condition of the uterus. No one stated that she had two uteri.

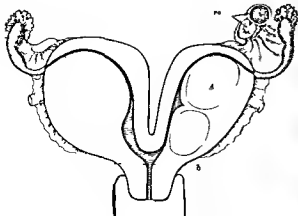
**Examination.** The patient is a rather large, heavy set woman and does not present the appearance of being very sick. She is not pale nor does she have the facial expression of one in severe pain. The head and neck are negative except for a bad set of teeth and a few cervical glands. There is no thyroid enlargement. The heart and lungs present nothing abnormal. There are no signs of rickets. The abdomen is somewhat distended and resonant throughout. On palpation there are no areas of tenderness above the umbilicus, but below this point the patient complained of pain on pressure, especially over the left side.

On vaginal examination it was noted that the perineum was badly lacerated. A small cystocele and rectocele were present. The cervix was lacerated and showed evidence of previous labors, but there was only one cervix. On the left side it was noted there was a soft, boggy mass about the size of a grapefruit. This mass was tender and freely movable. Slightly to the right of the median line another globular mass was found which was hard and taken to be the body of the uterus. This contained a moderate sized fibroid as it appeared later. The right tube and ovary were easily palpable. The reflexes were normal throughout. No varicosities were present in the extremities. The temperature, pulse and respiration were normal.

On these findings a diagnosis was made of a probable unruptured ectopic pregnancy with fibroid uterus.

The patient was operated on four days later and a median incision made from the umbilicus to the upper margin of the bladder and two uteri were found, each about the size of a grapefruit. Each uterus had only one tube and one ovary attached to it. We then realized we had to deal with a pregnant uterus bicornis unicollis with one horn containing a large fibroid and several smaller ones (Fig. 1). Both cornua with ovaries and tubes attached were removed intact at the junction with the cervix. The left ovary contained the corpora lutea. The right ovary was found to be normal. It was sectioned and one portion sewed in the peritoneal cavity and the other half to the rectal fascia.

The abdomen was closed in the usual manner and the intact specimen was sent to the Department of



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The larger ovum *l* was firmly implanted on the ventral (anterior) and mesometrial walls of the cornu just below the uterine ostium of the tube. It measured 60 by 50 by 5 millimeters its long axis corresponding with that of the uterine horn the shortest with the dorsoventral diameter. It contained a normally developing embryo measuring 7 millimeters crown rump length (Fig. 6) which corresponds to a trifle over eight weeks of development.

The left ovary which was removed with the horn measured 20 by 60 millimeters most of its bulk consisting of two corpora lutea each 16 millimeters in diameter. They are shown in section in Figure 1 and it is apparent that one contains much more lutein tissue as it is almost solid while the other has a large central cavity. They are histologically identical and contain no lipid stainable with Sudan III or Scharlach red.

The question naturally arises: Are the two ovaries from simultaneous or successive ovulations? Is it a case of fraternal twins or superfetation? The greater size of the ovum *b*, the better developed placenta and embryo indicate that it was several days older than *a*. The fact that one corpus luteum is solid the other hollow would seem to show that the former is older since both are equal in diameters. On the other hand corpora lutea of the same age often vary greatly in macroscopic appearance. There are no microscopic differences between corpora of seven and eight weeks. The difference in the ovaries and embryos might be due to the more favorable implantation site of *b*. The chorion of *a* is abnormally small as compared to the embryo and the stunted nasal region of the latter as well as the poorly developed placenta may be taken as evidence of inadequate nutrition. The only positive evidence then which favors the interpretation that there were two ovulations one a week after the other is the greater amount of lutein tissue in one corpus luteum.

The material was prepared as follows: The excised cornua and the left ovary were fixed about an hour after removal having been kept at room temperature in the interim. The two embryos, the entire chorion of *a*, portions of the implantation site of *b* and slices of the corpora lutea were placed in formalin chrom. sublimate solution. Other parts of the placenta *b* and of the corpora lutea were fixed in the formalin bichromate mixture of Regaud for the study of the mitochondria. The rest of the material and the whole right cornu were preserved in 10 per cent formalin neutralized with magnesium carbonate. The fixation was therefore fairly prompt and perfect as only small pieces were used and none of the conditions described below can be ascribed to postmortem change or inadequate fixation.

The fibromyoma in the right cornu measured 13 by 62 by 60 millimeters and there were in addition many small tumors of the same kind scattered through the wall. All are of the usual type without any sign of cystic degeneration. In this horn as in the other there was a well marked outer longitudinal muscle layer particularly well developed on the anterior surface. This condition reminds one

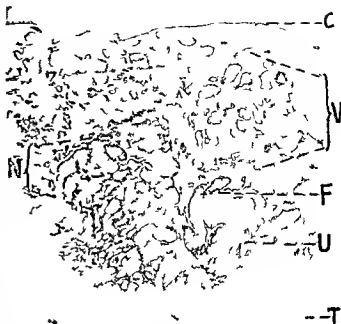


FIG. 3. A general view through the middle of the placental area (x7) fixed in formalin chrom. sublimate solution stained with hematoxylin and eosin. C. Chorionic villi; V. villi of fibrinoid tissue; F. uterine gland; U. tunica muscularis uteri; T. necrotic areas.

strongly of the longitudinal muscle layer characteristic of the uterine cornua of lower mammals. The endometrium of the right horn presented the rugose velvety appearance of a decidua vera and is histologically indistinguishable from the decidua vera of the left horn in which the ova were implanted. There were blood clots within this decidua but none on the surface. As most of them were organizing they could not have had any relation to the hemorrhage of the previous week.

**Histological details.** As Figures 3 and 5 show the placenta of embryo *b* is typical for this stage of development. The figures will serve to describe its general characters so attention will be called only to certain features. The nomenclature is that employed by Grosser (1900 and 1901).

This ovum was held firmly in place by numerous anchoring villi and there are large areas of proliferating cytotrophoblast (basal ectoderm). This is in marked contrast to ovum *a* which shows hardly any basal ectoderm. Trophoblast does not everywhere line the maternal side of the intervillous space in *b*. It is easy to find small areas where nothing separates the decidua cells from the maternal blood except a delicate film of corium which does not give a fibrin reaction. There is abundant evidence for the migration of fetal elements into the decidua. Rows of such cells can be found migrating in single file from the basal ectoderm; these are slender fusiform elements with pyknotic nuclei. In addition multinuclear masses of trophoblast which closely resemble syncytium can be found among the

FIG. 3, 4. Left. Placental area (x7) fixed in formalin chrom. sublimate solution stained with hematoxylin and eosin. C. Chorionic villi; V. villi of fibrinoid tissue; F. uterine gland; U. tunica muscularis uteri; T. necrotic areas.



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The only abnormal features of the placenta is the abundance of the masses in the decidua adjacent to the intervillous space. The margins of these areas are densely infiltrated with leucocytes and they may cover regions assuming by small masses. Figures 3, 4 and 5 show the more common

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form of these areas. They have a p found nec os  
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than the collagenic fibers. The other takes the specific opaque blue color of fibrin and may be mingled with the first or separated in a distinct layer. Occasionally it may be wanting. There may be very little of the fibrin or it may be abundant in a given region sometimes it is absent altogether. In some places this stria is wanting in others it extends deeply into the decidua in the form of a coarse network. The latter appearance is the only indication of the stria of Nitabuch.

Ovum *a* as has been said may have begun to abort. The implantation site does not show the great masses of basal ectoderm anchoring the villi as is the case in *b*. The villi appear normal show abundant mitosis in the Langhans' layer and a perfect brush border. The extensive infiltration of the decidua by fetal elements is wanting in this case.

Three factors may be concerned in this first the abortion was probably in progress

for over a week second the implantation site was less favorable than that of ovum *b* and it is quite possible that this ovum was implanted later than *b*.

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## INTUSSUSCEPTION OF THE JEJUNUM ASSOCIATED WITH TWO PEDICLED FIBRO-ADENOMATA

### REPORT OF A CASE<sup>1</sup>

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**A**MONG the numerous and varied types of cases received at the U. S. Army General Hospital No. 9, an unusual case of intussusception of the jejunum associated with two pedunculated intraluminal fibro-adenomata was recently observed and because of the long duration of symptoms and the varied interpretations and ultimate findings it was of sufficient worth to bear special consideration. The rarity of this type of obstruction occurring in the region of the bowel involved makes it of special interest.

Pvt. W. B., age 22, colored farmer, family history negative. About one year prior to his induction into the Army, August 14, 1917, the patient had frequent attacks of a diffuse abdominal pain but not severe enough to disqualify him from service. He landed in France, February 8, 1918, and did full duty until June 1, 1918, when he was taken with a sudden violent attack of diffuse pain in the abdomen accompanied by vomiting, constipation and marked prostration. He was removed to the American Red Cross Hospital No. 5 and later sent

to Base Hospital No. 8 for observation and treatment. The acute symptoms disappeared after a short time but recurred at various intervals rendering him unfit for further service. He was returned to the States landed at Ellis Island, August 8, 1918, and six days later was sent to U. S. A. General Hospital No. 9 with the various diagnoses as probable gastric or duodenal ulcer or tuberculous peritonitis. Three doses of salvarsan had been given at Base Hospital No. 8.

On the medical service his case was carefully studied. Vomiting and constipation occurred at frequent intervals. There was no blood in the stools. At times a small mass was palpable over the left epigastrium. There was no special point of tenderness but diffuse pain was present over the whole abdomen during these attacks which occurred one half to three hours after eating. Distention of the epigastrium followed but subsided if vomiting occurred. A slight rise in temperature would follow these exacerbations. An x-ray examination showed what was interpreted to be a prolapsed colon but nothing else of importance was noticed. Frequent gastric stool urine blood Wassermann and gento urinary analyses were made all of which were negative. The presence of filaria was disproved. Regardless of the therapeutic measures used, his symptoms continued to recur but his progress sheet

records days when he was up and about and absolutely free from symptoms

Dec 22 he was referred to the surgical service. An exploratory operation was advised but this the patient refused to submit to at this time. The attacks occurred at more frequent intervals. He had lost 38 pounds in weight though his appetite was good but the ingestion of food was later followed by retching and vomiting of large quantities of fluids with exhausting effects. Lavatives increased his distress and frequent enemata were necessary.

The last week in December an examination of the gastric contents showed a hyperacidity and contained remnants of undigested food. Stool and blood analysis negative. The patient was erythematous and his facial expression evidenced great distress. The abdomen was flat except over the left epigastrium where there was a well formed mass but there was no marked tenderness over the stomach or duodenum. The mass refused to assent to the feel and upon grasping could disappear but could return later. The presence of an intestinal obstruction as evident. This was substantiated by another series of X ray pictures and fluoroscopic examinations (First Lieutenant Milton Glover). The stomach emptied itself freely and rapidly the cap of the duodenum and the walls of the stomach were smooth and free from any crater or depression and showed an absence of gastric or duodenal ulcer or tumor thus eliminating this condition which had been offered as a probable diagnosis. A picture taken about 5 minutes later with the patient in a prone position showed a large mass with peculiar sunburst radiations of bismuth within its boundary in the upper left abdomen below and indenting the greater curvature of the stomach and extending downward. The presence of an obstruction on the small bowel high up as evident though the exact nature was still problematical. A later picture showed the colon to be normal.

As his condition became more grave an exploration was made January 1919 through a left rectus incision. The stomach duodenum and colon were found to be normal but a portion of the small bowel was injected and distended. Upon further examination a mass proven to be an intussusception of the jejunum containing two intestinal tumors, one above and one below the point of invagination 12 inches from the fossa of Jonsnesco was delivered from the left epigastrium. The circulation was not impaired and though the bowel was highly injected and swollen there was no evidence of strangulation but as there was an absence of adhesions of the layers of the involved gut it was reduced with but little difficulty.

There were no enlarged glands but the entirety of the involved section of bowel was more than three times that of normal and contained dense fibrous tissue showing evidence of former severe inflammation. A further examination of the bowel revealed two fixed pedicled intraluminal tumors

about 4 inches apart. Shortly after reduction there was visible a marked retrogressive peristalsis with a drawing up of the large tumor into the proximal section of the bowel showing a tendency toward recurrence. Because of this and the condition of the mesentery a 10 inch section of the bowel with its mesentery was removed an end to end anastomosis was made and the abdomen closed. There was no nausea following the operation the patient passed gas after the first 36 hours and made an uneventful recovery with complete freedom from the former symptoms. The removed section contained two pedunculated tumors about the size of a golf ball and one of which the pathologist reported to be benign fibro adenomata (Fig 1).

Because of the section of the bowel involved the presence of tonic waves and a retrogressive peristalsis showing a tendency toward recurrence when reduced this case was of special interest. These retrogressive waves are common in the large bowel but unusual in the small intestine.

As a rule the symptoms of ileus are the same regardless of the causative factors but depend almost wholly upon the degree of obstruction the region of the bowel involved and the preservation or occlusion of the circulation. The severe colic like pains followed by vomiting and frequently by a mucous hemorrhagic bowel movement and later by obstipation abdominal distention and shock are the cardinal symptoms of obstruction but it is not an uncommon occurrence for an impaction of the large bowel extending over a weeks duration to result only in comparatively mild symptoms as a headache or slight degree of malaise. Because of the other different physiological conditions involved if this same degree of obstruction occurs higher up the symptom will always be more violent and may lead to varied interpretations. If the occlusion be complete or partial we have an increased peristalsis below the point of obstruction with a complete emptying of the bowel. Above the same increased peristalsis occurs but later subsides the fecal material becomes deposited secretions and fluids accumulate and the bowel becomes greatly distended. The contents ferment and undergo putrefactive changes. The bacteria present may pass through the denuded mucous lining and intima into peritoneal tissue and result in a secondary

peritonitis. Even a partial occlusion will result in a stasis in the proximal portion of the bowel and the toxins here produced have a tendency to cause an inhibitory influence above the point of involvement. This will necessarily extend upward with resulting dilatation of the upper tract may pass the duodeno jejunal fold and produce a similar condition of the duodenum and stomach and result in symptoms other than ordinarily expected from an intestinal obstruction.

Tumors either malignant or benign in the lumen of the bowel are not uncommon but pedunculated masses only are associated with intussusception. They are by far more frequent in the large intestine and of these a large proportion are malignant. In this connection it is interesting to note the greater frequency of involvement of the descending colon and distal sections and associate with this the fact that in fetal life the formation of the large gut takes place on the left and gradually rotates toward the right. A large series of malignancies recently reported by Judd include 1689 carcinomata of the stomach, 1822 of the large bowel, 5 of the duodenum, 11 of the jejunum, 6 of the ileum and 7 multiple malignant growths of the small intestine. These figures serve to emphasize the rarity of malignant tumors in the small bowel. Any type of tumor is comparatively infrequent in this region but when present they are usually benign and project into the lumen as soft masses of varying diameters.

A tumor in the wall of the bowel will not cause invagination as it tends to strengthen it and prevent any folding. It is however not uncommon for an obstruction to be caused by a tumor in the wall or outside of the bowel, a malignant or inflamed diverticulum or a tumor involving some adnexa but in these cases pressure occlusions are found. Small tumors, e.g., an enlarged lymphatic gland at the ileocecal junction have caused invaginations into the caecal opening but this varies from the type of intussusception in question as in this case we have two sections of the bowel with varied sized lumina as associated factors. Balfour recently reported a case in which a large pedunculated



FIG. 1. Section of jejunum with two intraluminal pedicled fibro-adenomata.

papilloma of the sigmoid was associated with intussusception of this portion of the bowel. In his case too these retrogressive waves referred to above were present and there was visible a tendency toward recurrence of the reduced portion. Our observations must have been very similar.

Several theories have been advanced to explain this process of invagination. One is that after the tumor becomes sufficiently large to offer a certain degree of obstruction it stimulates increased peristalsis which forces it into the lower portion of the intestine with the result that the pedicle pulls upon the portion of the bowel to which it is attached and causes it to invaginate. Another disproves this idea but points to the increased peristalsis produced as the immediate cause of the invagination. The case just cited was of special interest in that a reverse condition too must have existed evidenced by the various factors enumerated, the observations made at the time of operation and the presence of a tumor above and one below the point of invagination.

Any case showing signs of obstruction without relief is a surgical one and if it be severe procrastination often spells fatality. If the condition remains undetermined and the diagnosis cannot be made otherwise an exploratory operation is called for. Upon the nature of the obstruction depends the mode of procedure. If a tumor within a small bowel is causing invagination its removal through a longitudinal incision of the intestine opposite to the mesenteric attachment



may be sufficient. But if there is a tendency toward recurrence as was evidenced in this case by the enumerated factors I believe the wisest plan is to resect the portion of the intestine involved. The operation if carefully done ought not to jeopardize the patient's life but will give more definite and beneficial results. In a similar condition of the large bowel a resection of the portion involved is advisable as it is a safe plan to consider all these tumors to be of a malignant nature unless a definite proof to the contrary is to be had. The extent of involvement must of course be considered and the mode of operation planned accordingly.

#### CONCLUSIONS

1. A complete or partial obstruction of the bowel will result in stasis and the formation of toxins which have inhibiting action on the proximal section and cause distention. If

this is progressive symptoms other than those at the original site of involvement will occur and may mask the real conditions.

2. Intramural tumors tend to strengthen the bowel wall and prevent invagination. Only pedicled tumors can be held responsible for intussusception.

3. Tumors of a malignant nature are infrequent in the small bowel but very common in the colon and distal portion of the intestine.

4. Because of the high rate of malignancy no tumor of the colon should be considered benign until definite proof to the contrary is established. In the upper tract such proof is not so necessary but if the tumor is associated with intussusception the safest procedure which can be followed to prevent a recurrence is the removal of the section of bowel which is involved together with the foreign body.

## THE SURGICAL TREATMENT OF INFECTIONS OF THE KNEE-JOINT

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THE following extract from a circular prepared in November 1918 at Savenay, France, will serve as a text for the discussion which follows:

One must discuss the questions of treatment of septic knee joints by immobilization or amputation and the question of drainage. The latter severe septic cases. By the work of Willemis it has been adequately shown that certain acute septic knees can be treated with intrathecal drainage and drainage. It is obvious however that this notion must be intelligently and carefully controlled. It is not to be construed that such patients may be permitted to travel from one hospital to another or to the United States without such immobilization either in a Thomas or plaster of Paris splint that they are permitted against automatism. Any of the septic cases may require additional drainage. All the ethical considerations of the patellar have been tried. One of the most valuable incisions for draining the popliteal space has been worked out and used by Captain L. C. Abbott. It

consists of about a 4 inch incision along the inner and posterior border at the upper end of the tibia. This follows up through the space under the insert of the popliteus into the knee joint and divides one of the most dependent and difficult of access synovial spaces in the joint. This incision may be extended upward over the back of the internal condyle. By keeping in direct contact with the bone the entire popliteal area can be drained with much less risk to the vessels than through any posterior incision.

Knee joint conditions in France presented themselves in two principal forms: first, the so-called internal derangements of the knee joint and second, the acute infections. It is with the acute infections that I desire to deal particularly in this paper. There were great differences among the acute knee joint infections. For convenience one may divide them into four principal forms:

1. Acute infection of the knee joint with the formation of pus but with no opening into the joint.

These conditions arose in connection with and as a consequence of a number of conditions e.g. acute infections. Arthritis of the knee joint was seen of course associated with pneumonia and various other of the acute general infections. *Streptococcus* infection was frequently observed following traumas of various sorts direct or indirect. A very considerable number were seen as the result of the injury caused when a man stepped into a shell hole or when he was buried by shell explosion and the knee was given a bad twist at the time. Direct contusion was a frequent cause and acute infections with the formation of pus occurred in which no traumatism nor any demonstrable general infection could be found.

## 2 A compound injury to the joint but with no damage to the bone

A considerable number of patients were seen in which acute infections of the knee joint with the formation of pus followed penetrating wounds by sharp instruments or in which a machine gun bullet or a piece of shrapnel had penetrated or traversed the knee joint without damage to the articular surface or the bones. These were not so rare as one might have supposed. A few cases were seen following exploratory operations on the knee joint or after the operation for internal semilunar cartilage.

## 3 A compound fracture of the femur or tibia involving the joint

This was the most common finding at the front and the condition resulting was one of the most formidable to treat. The injury was frequently of such a character that immediate serious infections supervened and the damage was often so great that a subsequent satisfactory knee joint could not be hoped for. Moreover the so called debridement operation was frequently employed in injuries of this character so that considerable portions of soft or bony tissues were removed which would have been necessary for a stable knee if one was to have been secured.

## 4 Late conditions of either 2 or 3 with general sepsis

Because of the character of the bony tissue both in the condyles of the femur and the upper portion of the tibia serious infectious processes commonly followed such injuries as are described above. When there was considerable loss of substance either in the lower end of the femur or in the upper end of the tibia with subsequent osteomyelitis of the remaining bone conditions developed both in the extremity and the patient which were most difficult to treat.

After an experience with several hundred

of these cases it was our conclusion that the methods of treatment to be employed must be quite different for each of the above classes of cases. The attempt to apply any general method of treatment to septic knee joints must lead as it has occasionally already to the attempt to apply a certain method to all conditions which after all can only be applied to one. This is illustrated in the matter of splinting. There are certain conditions as pointed out by Willems in which it is feasible to treat a septic knee joint and maintain motion so that the patient recovers without ankylosis. There are certain other conditions however in which it has been repeatedly shown that serious damage may be done to the knee and risk incurred for the patient unless the injured and inflamed parts are carefully and continuously immobilized. Our conclusions then with regard to the four classes of patients above specified were more or less as follows.

In those cases of acute inflammatory arthritis of the knee joint with the formation of pus with no opening into the joint it has been demonstrated we think by Willems and others that active and passive motion may be carried on throughout treatment especially if as pointed out by them motion is kept within the limits of pain and a movable knee joint secured in certain cases of this sort in which formerly we were accustomed to be satisfied with ankylosis. These joints must of course be adequately drained usually by lateral incisions and the sort of motion instituted which contributes to the emptying of the knee joint cavity of pus. When without too much pain or without causing any other irritation this motion can be maintained throughout healing may be secured with good motion. This method had a very limited use in the American hospitals more limited because of the fact that over enthusiasm for motion without a full understanding of the limitations of its use caused the method to be used in certain cases where harm resulted. It was also shown we think that in certain cases under group this method may be applied. It must be definitely understood however that such cases must absolutely comply with certain conditions.

Only in those cases of acute infection of the knee joint with the formation of pus which are seen early in which there is no damage to the bones and in which the damage to the articular surfaces is small free drainage may be instituted and by the method of Willem's the knee joint kept in motion during the entire course of the inflammatory process. In this way ankylosis may be prevented and a movable knee joint secured. Willem's and others have sufficiently demonstrated this to be a fact.

It is at this point however that we think it especially important for the line to be drawn. If the attempt is made as it has been on numerous occasions to carry out this same method of treatment in cases with more extensive damage either traumatic or inflammatory the risk is greater than is justified.

With regard to the treatment of gunshot or other wounds into the knee joint without fracture of the adjacent bone structures we think it has also been adequately demonstrated that an immediate debridement operation may be done the wound closed at once and the patient secure primary healing with complete function. Or the operation may be done at once the wound carefully packed or treated by the Carrel Dakin method and closed by secondary suture when the bacteriological findings are satisfactory.

Let us use the following as an illustrative case. A soldier was struck with a machine gun bullet which passed from front to back through the outer side of the knee joint. X-ray examination showed that no damage had been done either to the femur or to the tibia. He was brought into the first aid dressing station within three hours. A debridement operation was done at once and the wounds immediately closed. Healing followed by first intention. A few days later upon being moved to another hospital an acute inflammation of the joint supervened with the formation of pus. Lateral incisions were at once made for drainage. Motion of the knee joint was maintained the knee being moved freely twice during each day. During the remainder of the day the knee joint was flooded with Carrel Dakin solution. At the end of three weeks time bacteriological findings being satisfactory the wound was again closed and healing remained complete.

This case however is typical of only a very small group seen by the writer. In order to

make a comparison a different case will be described illustrating the danger of the method.

An officer was seen who had had a shrapnel injury several weeks before with slight damage to the upper end of the tibia. The wound was not closed primarily but after a short suppurative course the wound healed and the officer still had about 20 degrees of motion in his knee. As in the previous case transfer from one hospital to another was apparently responsible for a recurrence of acute infection. Considerable redness and swelling developed and the process went on to suppuration in the knee joint. Lateral openings were made for drainage and the extremity was put up in a Balkan frame with the idea that motion could be maintained. The knee joint was also carefully treated by the Carrel Dakin method but twice daily the patient himself by means of an overhead pulley extended and flexed the knee joint as far as he possibly could without too much pain. The knee drained well but the swelling did not subside and the entire area remained red and tender. After several weeks the wounds healed and more serious efforts were made to increase the range of motion. Just as the patient was about to leave his bed however another acute exacerbation of the process supervened osteomyelitis of the tibia developed and the patient's symptoms were so alarming that an amputation was done just below the middle of the thigh.

Another phase of the subject is illustrated in the following case which was seen in a British hospital.

A private soldier 33 years old received a compound fracture injury of the knee joint in the fall of 1916. After two or three acute attacks his condition finally settled down to a chronic osteomyelitis involving both the femur and tibia. At the time he was seen by the writer in the summer of 1917 he had six discharging sinuses from the knee joint. Partial external dislocation of the head of the tibia had occurred and the knee was fixed in about 25 degrees of flexion. He was able to get about on crutches but was suffering considerably from the effects of prolonged suppuration. In this case the point to decide was as to the relative merits and danger of amputation or resection of the knee joint. The latter was decided upon and such an operation was performed as is usually done in tuberculous knee joints of a similar sort. A most gratifying result was obtained in this case both ankylosis and healing of all sinuses occurring within weeks so that the man had only about 15 inches of shortening and walked very well. He also gained very rapidly a general health.

It is important to observe however that a very considerable number of such cases after a long hard fight to save such an extremity

nnally come to the inevitable amputation. In general it may be said that compound injuries to the knee joint with damage to the upper end of the tibia or to the lower end of the femur or both in which serious infection occurs at the time might as a rule better be amputated at once. The extremity which can be saved is in a large majority of cases not a useful one and the risk to life is very great. It may be said that the knee joint ward at Savenay where we had 37 beds for the more serious cases of this sort contained at all times more patients who were seriously sick than almost any area of similar population in our hospital.

One of the most difficult decisions for a surgeon to make is that involved in the cases under group 4. A considerable number of cases was seen of which the following is a typical illustration.

Captain G. came to Savenay with a compound fracture of the femur in the lower third. A considerable amount of pus pocketing in the soft tissues of the thigh had already occurred when he arrived. He was running a temperature course of from 101 to 103 daily most of the time. A few days after admission he was discovered to have pus in the knee joint as well. This was drained and the question of amputation considered. It was thought however that his condition did not justify amputation at that time. After repeated incisions on three different occasions he seemed to be well drained and his temperature assumed a more normal course. A little later however the temperature rose again and new pus pockets were discovered well up into the thigh. His general condition had improved slightly during the two or three weeks of better drainage. Amputation was thought to be necessary to relieve him of much of his infection and insure adequate drainage of the thigh. After a preliminary transfusion he was amputated by the guillotine method through the middle third of the thigh which immediately opened up large pus cavities not only in the soft tissue but in the shaft of the femur as well. No effort was made to get above this area. To the gratification of all of us his condition improved immediately and we had the pleasure of seeing him leave Savenay for the United States in excellent general condition and with a stump that was almost healed.

One cannot say that all of these cases should be amputated early, but it is certain that in a considerable number an effort was made to save extremities which by no possibility could have been made useful even if they

had been preserved. Also the time often comes when amputation in the presence of general sepsis is a much more formidable procedure than it would have been earlier. The writer is one of those who by reason of the military experience has been converted to the belief that amputation is more often justifiable in these cases than he had formerly thought. *It is important to specify however that in those cases where an effort has been made to preserve such an extremity and where general sepsis recurs with accumulation of pus in the knee joint and in pockets up and down the leg and thigh amputation is not always the first thing to be thought of.* It is our experience that very extensive drainage was often a means of saving a life and of putting the patient in better condition for an amputation which had to be done later. The mortality of thigh amputation in general sepsis during the height of the attack is very high indeed and it was demonstrated at Savenay that this mortality can be greatly reduced even if only a few days of complete drainage are provided before the amputation is done. In a few instances also it was found that reflection of the patella with free opening of the pus pockets and the thigh enabled us to save the extremity while in others amputation became an apparently simple procedure in stead of involving a large element of risk which had been observed without the preliminary drainage.

At one time a considerable number of patients with compound fractures of the knee joint which had become septic were being amputated without much discussion. Our later and more extensive experience convinced us that limbs and lives can be saved by this plan of employing adequate drainage sometime if only as a preliminary to an amputation that may be inevitable. One method of drainage is referred to in the introductory paragraph. Another is of course by reflection of the patella and postoperative employment of thorough antiseptic treatment. If a patient is carried by his most acute septic period in this way amputation if necessary can be done later either through the knee or in the thigh when required. In all of these cases the point of adequate postoperative

splinting must receive the most careful consideration. This may occasionally be accomplished satisfactorily by overhead suspension in the Balkan frame with weight and pulley traction. As a rule however the use of the internal traction splint as employed by the British is more satisfactory than anything else.

The method to be used in splinting these patients is essentially the same as that described in femur fractures in the circular already referred to. In cases where the wound will permit its use plaster of Paris is the ideal splint. A spica should usually be used in splinting the knee.

The Thomas splint should be applied and cared for always in the same manner. The introduction of individual methods invariably leads to a loss of efficiency as patients pass from the hands of one surgeon or hospital to another. The following points must be observed. A long splint and a well fitting rubber mat be selected. It must be bent to an angle of 90 to 135 degrees at a point 1 inch above the level of the knee joint. Hair (regard for wounds the adhesive traction bands (of Snelcar glue or moleskin plaster) must include as much skin of the leg and thigh and extend as high as possible. The traction ropes for the distal end attached to the lower end of the adhesive should be 1 1/2 inch rope of 4 ply muslin fastened very securely into the adhesive so that it will not give a undue pull of 15 to 20 pound. Muslin hammock of not more than 4 inches in width should be placed across the splint for its entire length at a sufficient tension so that the leg rides well on the top of the splint. The splint is then put on and the traction straps tied firmly over the lower end with the ring tight against the bony point of the iliac crest. A right angle foot piece is put on and the foot and knee bandaged so that

it is as to put the entire extremity at rest in the splint. The twisting of the traction bands should have attention once or twice daily. The lower end of the splint should be tied to the outer end of the foot of the bed in such a position that the lower end of the femur rotates slightly outward. The foot of the bed should be raised 12 inches so that the patient's body acts as a counterweight to pull against the anchored splint. By following exactly this technique it has been possible at Savenay to demonstrate an average gain in length of more than 3 centimeters in a series of over 300 cases. In dealing with open wounds in this splint it is only necessary to release one or two of the 4 inch hammock. Care must be taken so that the entire area of the fracture is not moved or allowed to sag below the level of the normal anterior curve of the femur.

#### SUMMARY

In only a few cases belonging to group 1 and in no case of groups 3 and 4 should an attempt be made to secure a movable knee joint. Ankylosis is the end to be sought with the knee at an angle of from 10 to 30 degrees. Attempts to secure motion except by very late arthroplasty should be discouraged. In fact the patient of either of these groups who recovers with the ankylosed knee in good walking position can be counted almost as brilliant a result as the one of the other classes who recovers with a movable knee joint. No attempt should be made to reestablish motion in one of these ankylosed knee joints except by late arthroplasty. Even such attempts should only be made upon the advice or in complete harmony with the methods of a surgeon who like Colonel Baer for example knows exactly the field and limitations of this formidable procedure.

## OBSERVATIONS UPON INTERNAL PILES

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IT is perhaps a commonplace to say that internal piles constitute a very common complaint but it is nevertheless true. About 80 per cent of people who have reached middle life suffer from internal piles in some degree of severity. As a rule the disease commences during the latter end of the third or at the early part of the fourth decades of life and is progressive in character. Occasionally younger people are affected but in them there is usually some predisposing cause such as hereditary tendency, the association of other diseases denoting general laxity of tissue e.g. varicose veins of the legs, varicocele, hernia etc. or prolonged and severe physical strain. During the Great War I saw a large number of cases of internal piles in an advanced stage of development among quite young soldiers. The age of these patients between 19 and 25 years was in marked contrast with that usually observed among patients in civil hospitals and can only be explained by the fact that during the war large numbers of young men were suddenly called upon to undergo severe physical training after having been engaged in more or less sedentary occupations for several years.

The disease is progressive in character and passes through definitely recognizable stages. During the early stage subsequent progress may be indefinitely delayed by judicious treatment but in the later stages the only satisfactory treatment is surgical eradication.

To ensure efficient treatment a comprehensive knowledge of the pathology of internal piles is essential so with this end in view I propose to draw attention to some of the observations that I have made during an experience extending over 10 years gained in a special hospital for diseases of the rectum.

## CLASSIFICATION OF INTERNAL PILES

Three varieties of internal piles are usually described namely (a) the arterial (b) the capillary and (c) the venous. Such

a distinction does not really exist and is of no practical value whatever.

An internal pile consists of a conglomeration of blood vessels in the submucous tissue of the anal canal and of the lower part of the rectum which have become enlarged and tortuous and whose coats have undergone pathological change partly hypertrophic and partly fibrotic. Arteries, capillaries and veins simultaneously participate in this change so that any given internal pile is made up of a mixture of three kinds of altered blood vessels. The arbitrary division into the three varieties mentioned above is no doubt due to the fact that whereas some piles bleed readily others do not and also that whereas some are similar in color to the mucosa others exhibit a purplish hue. These differences however indicate degrees of development rather than variety in structural composition. There is therefore only one kind of internal pile and this during the process of development undergoes certain changes in external appearance and in structure.

## STAGES IN DEVELOPMENT

Internal piles are progressive in development and pass through three distinct stages (a) primary (b) intermediate and (c) final. It does not necessarily follow that all the internal piles present in a given case are in the same stage of development. In fact this very rarely happens it being a common experience to find that with the exception of very old standing cases all the stages are represented.

*The primary stage.* When seen at this stage an internal pile is small and covered with healthy unaltered mucosa. Its presence cannot be recognized by digital exploration owing to the small size of the tumor and to the compressibility of the dilated vessels. It is not sufficiently elongated to allow of it being protruded through the anal orifice though it may be long enough to permit of the lower extremity being gripped in the sphincter.

teric zone during an expulsive effort. An internal pile in this stage of development bleeds readily, often profusely whenever engaged in the grip of the sphincters, because the mucous membrane covering it still preserves a delicate structure and has not yet become thickened and tough through long continued friction. The only symptom to which an internal pile at this stage of its history gives rise is *hemorrhage*. This is often profuse and is repeated with each act of defecation. The blood passed is bright red in color, a circumstance which no doubt has given rise to the idea that an internal pile in this stage of its existence is arterial in structure. From the symptomological point of view the equation may be thus represented:

Bleeding—recurrent, often profuse, during defecation, and usually bright red in color.

Protrusion—nil.

*The intermediate stage.* From constantly being dragged upon by the action of the sphincters during defecation an internal pile becomes progressively elongated. When sufficiently elongated to permit of protrusion through the anal orifice it may be said to have reached the intermediate stage of development. Concomitantly with increase in length the internal pile increases in bulk, partly from increased dilatation of the component vessels and partly from exudation into the areolar connective tissue. From repeated protrusion the mucosa becomes thickened with the result that bleeding is less frequent and much less profuse than in the preceding stage. A characteristic feature in regard to protrusion is that the protruded pile becomes spontaneously reduced as soon as the expulsive effort has ceased or almost immediately afterward. After reduction has taken place protrusion does not recur until the next act of defecation. Owing to changes in the mucosa the pile has lost some of its original bright red color. The symptomological equation at this stage is:

Bleeding—less frequent and less copious, several actions of the bowels often taking place without bleeding at all.

Protrusion—occurs with every act of defecation, is spontaneously reducible and does not tend to recur except during defecation.

\* When an internal pile has reached the intermediate stage of development its presence can readily be detected by the examining finger as a thickened longitudinal fold especially if the finger be rotated upon its axis during the observation. A pile in this stage can also be seen to protrude when the patient forcibly strains down.

*The final stage.* This stage is considered to have been reached when the protrusion is pronounced, is continuous and does not become spontaneously reduced. The protrusion requires manual reduction after each act of defecation. Even after manual reduction has been effected recurrence of the protrusion takes place on slight provocation such as passing flatus, coughing, sneezing, walking or standing for any length of time. The pile has also increased materially in size, a considerable proportion of its bulk consisting of fibrous tissue. The mucosa from constant rubbing against the clothing has become thickened and tough. Its color the pile has assumed a purplish hue. Bleeding seldom occurs owing to the thickened mucosa. If bleeding occurs from piles which have apparently reached the final stage it is either due to traumatism or to one of the piles not having passed beyond the primary or intermediate stage.

The symptomological equation during this stage is:

Bleeding—nil.

Protrusion—continuous, unless manually reduced, marked tendency to recurrence during slight exertion.

The recognition that there are *three distinct stages* in the development of an internal pile is of great practical importance because in any given case it is exceptional to find that all the piles have reached the same stage. In fact it is not uncommon to find that while one pile has reached the final stage that is to say is obviously protruded a second may only come into view when the patient forcibly strains down, whereas a third may not be capable of being protruded at all and cannot be recognized during digital exploration. Such a pile is still in the primary stage of development, is probably the cause of the bleeding complained of and may be overlooked when

an operation is being performed. Consequently in such a case if the obvious piles only are removed while one still in the early phase of development is left behind hæmorrhage, one of the chief symptoms for which an operation for piles is performed may recur after an interval of a few weeks or months.

#### THE NUMBER OF INTERNAL PILES WHICH MAY DEVELOP

When every possible internal pile has been developed such for instance as may occur in an old standing case which has never been operated upon there are usually seven and only seven piles present. Very exceptionally (5 per mille) there may be an eighth. This is due to the fact that the branch of the superior hæmorrhoidal artery which is distributed to the right side of the rectum after reaching the submucous tissue ultimately breaks up into four branches whereas that which is distributed to the left side of the rectum breaks up into three branches only except in rare instances when it may give off a small fourth branch.

In about 70 per cent of cases there are only three or four piles present and these are usually found to be in different stages of development. Even in cases of old standing which have never been subjected to an operation the full complement of seven piles are seldom present because at some time or another one or more of them may have sloughed away as a result of spontaneous strangulation (*vide infra*).

#### THE DISTRIBUTION OF BLOOD VESSELS TO THE TERMINAL PORTION OF THE RECTUM

The arterial supply of the lower portion of the rectum and of the greater part of the anal canal is derived from the superior hæmorrhoidal artery which is the terminal branch of the inferior mesenteric. The superior hæmorrhoidal artery divides into two primary branches one for distribution to the right side of the rectum and the other to the left side.

*On the right side* This branch after having perforated the muscular coat enters the submucous tissue and almost immediately divides into two branches, an anterior and a posterior branch. The anterior branch passes down in

the right anterior quadrant of the rectum and finally breaks up in a meshwork of small vessels in the submucous tissue of the anal canal. This branch does not give off any branches.

The posterior branch passes downward in the right posterior quadrant to terminate in a meshwork in the anal canal and on its way gives off two branches, an anterior which passes downward along the line separating the right anterior quadrant from the right posterior quadrant that is to say toward the right point in the anal circumference and a posterior which passes downward in the middle line posteriorly.

*On the left side* This vessel after perforating the muscular coat passes downward in the submucous tissue along a line dividing the left anterior from the left posterior quadrants toward the left point of the anal circumference and remaining single until near its termination gives off two branches, one anteriorly which is distributed to the left anterior quadrant and the other posteriorly which supplies the left posterior quadrant.

The distribution of the veins is similar to that of the arteries. They arise in a minute plexus which is found in the submucosa of that portion of the anal canal which is bounded below by Hilton's white line and above by the valves of Morgagni. This zone is known as the pecten.

When pathological changes take place in these vessels rendering them tortuous dilated and thickened the vessels which are affected first are the larger or main branches. The smaller or secondary branches become involved later. Consequently the first vessels to undergo pathological change are those distributed (a) to the right anterior quadrant, (b) to the right posterior quadrant and (c) to the left point. Hence the piles which result from these early vascular changes may be spoken of as *primary piles*.

Similarly the piles developing in connection with the secondary branches namely those distributed (a) to the right point (b) to the middle line posteriorly (c) to the left posterior quadrant and (d) to the left anterior quadrant may be considered to be *secondary piles*.



# THE POSITION OF INTERNAL PILES IN RELATION TO THE CIRCUMFERENCE OF THE ANAL CANAL

Since the anatomical distribution of the various branches of the superior hæmorrhoidal vessels is constant each branch supplying a definite area of the circumference it follows that the piles which develop in connection with those vessels preserve an invariable position in relation to the circumference of the anal canal

The primary piles are three in number and are always found in the same relative position namely (1) in the right anterior quadrant (2) in the right posterior quadrant and (3) at the left point in the circumference of the anal orifice Accordingly these primary piles may be designated the right anterior the right posterior and the left internal piles

As above mentioned these three piles are the first to be developed a fact which I have found to be amply borne out by clinical experience According to my records in about 70 per cent of the cases of piles examined the presence of these three piles is revealed and it therefore appears that this is by far the commonest combination It does not necessarily follow however that all the three piles are in the same stage of development so that if one of them has only reached the first stage it might escape detection when an operation is being performed unless special y looked for

The secondary piles develop in connection with the primary and are practically offshoots from them The arterial branch which is distributed to the right anterior quadrant does not give off a branch hence a secondary pile is not associated with the right anterior (primary) internal pile

The arterial branch distributed to the right posterior quadrant gives off two branches and accordingly two secondary piles are developed in connection with the right posterior (primary) internal pile namely (1) a pile situated at the right point in the anal circumference the right internal pile and (2) a pile situated in the middle line posteriorly the posterior internal pile

Similarly two secondary piles are developed in connection with the left (primary) internal

pile namely (1) a pile situated in the left posterior quadrant the left posterior internal pile and (2) a pile situated in the left anterior quadrant the left anterior internal pile In connection with this latter there rarely may develop a small anterior internal pile

The secondary piles therefore are the right the posterior the left posterior the left anterior and very rarely the anterior

There are therefore seven or in very rare instances eight internal piles which may possibly be developed in any given case and whose position in relation to the circumference of the anal canal is constant Commencing at the middle line anteriorly and passing around the circumference in a direction opposite to that of the hands of a clock these piles are

- 1 Anterior very rare (secondary)
- Right anterior (primary)
- 3 Right (secondary)
- 4 Right posterior (primary)
- 5 Posterior (secondary)
- 6 Left posterior (secondary)
- 7 Left (primary)
- 8 Left anterior (secondary)

The secondary piles are moreover closely connected with the primary piles from which they are developed Thus in instances in which all the possible piles are present the following constant arrangement will in variably be found The anterior pile when present is usually connected with the left anterior above but is separated from it by a sulcus below

The right anterior pile is always discreet and is never coalesced with any other pile

The right pile is practically coalesced with the right posterior while the posterior though separated from the right posterior by a sulcus below is blended with it above

The left posterior is coalesced with the left whereas the left anterior is separated by a shallow sulcus from the left By this arrangement it will be seen that in those instances in which all the possible piles are present they are formed into three groups

Group I Right anterior

Group II Right+right posterior+posterior

Group III Left posterior+left+left anterior+anterior

Consequently when performing a ligature operation it is never necessary to apply more than three ligatures even when seven or eight piles are present.

The practical advantages of bearing in mind the relative position of internal piles are two fold viz

1 One knows exactly where to look for the piles and does not run the risk of missing one which happens to be in an early phase of development

2 It enables one definitely to determine whether supposed postoperative recurrence is due to regrowth of piles which have previously been operated upon or whether there has been a subsequent development of piles which did not exist at the time of the previous operation—for instance if the record of the previous operation reveals that the right anterior the right posterior and the left internal piles had been removed and if when the same patient presents himself on account of a recrudescence of symptoms it is found that the posterior and the left anterior piles only are present then it is obvious that the case is not one of recurrence but is one of subsequent development of piles which did not exist at the previous operation

#### EFFECT OF THE PRESENCE OF INTERNAL PILES UPON THE TISSUES OF THE ANAL CANAL

Varicose veins in any situation lead to passive congestion in the tissue from whence they arise. The passive congestion thus engendered ultimately results in fibrous induration. Evidence of such induration as a sequela to passive congestion is well exemplified in the case of the indurated zone in the neighborhood of a varicose ulcer of the leg. The same kind of thing takes place as a result of internal piles. The branches of the superior hemorrhoidal veins arise in a minute capillary plexus situated in the submucous tissue of the pecten. When these vessels are varicose this plexus becomes the seat of passive congestion with the result that a deposit of fibrous tissue takes place in the submucous tissue of the pecten. The fibrous deposit takes the form of a circular band varying in thickness and density completely surrounding the lower part of the anal canal and sit-

uated between the mucous membrane of the pecten and the external sphincter muscle. In well marked instances the band of fibrous tissue can be distinctly felt and gives an impression to the examining finger such as would be obtained if a rubber umbrella ring had been inserted beneath the skin at the anal margin. I have named this deposit of fibrous tissue in the submucosa of the pecten the *pecten band*.

The pecten band does not exist in the healthy anal canal. It is purely pathological in origin. It is due to passive congestion engendered either by the varicosity of the superior hemorrhoidal veins or possibly in some measure to impediment to venous return as a result of habitual pressure upon the veins of the rectum induced by the loaded state of the rectum in the chronically constipated. It varies both in thickness and in density in different cases. It limits the expansibility of the anal orifice just as effectively as would a piece of whipcord if tied loosely around the anal canal. In nearly all cases of internal piles two characteristic symptoms due to the presence of the pecten band manifest themselves apart from those due to the piles themselves. One of these is difficulty in obtaining complete emptying of the rectum during defaecation and the other is diminished size in the caliber of the faeces passed the motions being generally voided in short pieces about the size of an ordinary index finger. Both of the symptoms are due solely to the presence of the pecten band and both of them disappear when the band has been divided.

The limiting effect of the pecten band upon the degree of relaxability of the external sphincter muscle is responsible for the straining at stool during the passage of formed faeces and also for strangulation of piles when a large mass has become prolapsed through the anal orifice. Such a strangulation is usually considered to be due to spasmodic contraction of the external sphincter under the stimulus of painful protrusion but it is clearly not due to muscular contraction because a muscle is incapable of keeping up tonic contraction for an indefinite period without relaxation. The constriction is due to the unyielding pecten band just in the same

way as the rigid margin of the entrance to the femoral canal constricts the portion of intestine or of omentum which has been forced into it

#### TREATMENT OF INTERNAL PILES

When internal piles begin to develop the disease is progressive in its course. When untreated piles in the first stage of development soon reach the second and third stages. This is in large measure due to the traction exerted upon the hæmorrhoidal tumors by the sphincters during the act of defæcation. A great deal can be done to retard this progressive development by judicious palliative treatment. Constipation should be combated by suitable mild aperients so as to render the motions soft and capable of being voided without undue straining. Drastic purgatives should be avoided. Protruded piles should be immediately replaced. For this purpose the patient should be instructed to pass the index finger encased in a rubber finger stall into the anal canal immediately after an action of the bowels so as to ensure that the piles are pushed well up beyond the grip of the sphincter muscles. This can be done if the finger be passed as far as the terminal interphalangeal joint. Even in cases in which protrusion has not yet occurred it is a good plan to get the patient to pass his finger smeared with ointment into the anal canal both before and after each action of the bowels for these reasons: first the lubrication of the surface of the anal canal ensures the transit of the fæces with a minimum of friction and consequently there is less likelihood of existing piles being pushed down into the grip of the sphincters; secondly the passage of the finger after an action ensures that any pile which may have been pushed down is disengaged from the sphincteric grip. Palliative treatment of this kind if conscientiously carried out is often successful in retarding progress through the stages and an operation may never become necessary. In a certain proportion of cases however palliative treatment is of little avail and sooner or later an operation becomes inevitable.

*Indications for operation.* It is quite a mistake to assume that every case in which the

symptoms indicative of internal piles are present needs operative interference. It often happens that such symptoms entirely subside after a few days rest in bed with attention to diet and may not be repeated for many months or even years. In such cases it is obviously unnecessary to recommend an operation. When however attacks recur at frequent intervals and the symptoms become more pronounced with each successive attack the question of operative interference must arise.

The indications for operation are two namely (1) copious and recurring hæmorrhage (2) uncontrollable protrusion.

*Hæmorrhage.* Slight and occasional bleeding is not of much moment but when a patient loses considerable quantities of blood at every action of the bowels his general health soon begins to suffer. He becomes obviously anæmic and the anæmia is progressive. Under these circumstances the sooner an operation is performed the better. It is a mistake to regard the presence of anæmia as a contra-indication to operation because the anæmia is being produced by daily losses of blood and therefore it will increase in severity so long as the hæmorrhage is permitted to recur. It is time enough to take measures for combating the anæmia after the operation has been performed.

*Protrusion.* So long as the protrusion is amenable to reduction and does not recur until the next act of defæcation it is only a nuisance and can be tolerated. When however the protrusion recurs almost immediately after reduction after slight exertion such as walking or standing or during light expulsive efforts such as passing flatus or during micturition the disability becomes a menace to health. A patient suffering from this condition is precluded from taking adequate exercise is unable to follow his occupation and his life becomes unendurable. Under these circumstances an operation should be recommended without hesitation.

*Selection of an operation.* Many operations have been devised from time to time for the cure of internal piles. These fall into four categories viz (1) ligature operations (2) operations by excision (3) operations by

clamp and cautery and (4) some form of injection into the tissue of the pile. It does not appear to matter much which particular method be adopted provided that the operation is performed efficiently. Some methods however entail the loss of a considerable amount of blood so that it would obviously be unwise to select such an operation for a patient who has been reduced to a condition of pronounced anæmia on account of daily copious losses of blood at stool. An operation for internal piles should show 100 per cent of cures. There should be no failures due to the operation itself. The operation should be regarded as having been a failure if (1) the symptoms for which it was undertaken either persist or recur within a period of ten years (2) if symptoms which did not exist prior to the operation develop immediately afterwards. Failure is due to two causes (1) faulty technique on the part of the surgeon (2) sequelæ which are due to the operation itself and therefore out of control of the surgeon.

The first can be remedied by care on the part of the surgeon and by experience the second can only be combated by discarding that particular operation. As before mentioned an operation for internal piles should show 100 per cent of successful results and therefore if any particular method of operating is attended by even a small percentage of failures (say 2 or 3 per cent) which cannot be fairly attributed either to want of skill or to lack of experience on the part of the surgeon that method is bad and should not be practiced.

*Preparation before operation.* All patients before undergoing an operation for internal piles should be carefully prepared. It is a mistake to think that because the operation is a comparatively simple one little care need be exercised in this respect. The preparation should extend over two days during which period the patient should be kept in bed and should not be allowed to eat and drink what ever he chooses. Moreover he should not be allowed to smoke. Smoking especially cigarette smoking in which the smoke is inhaled often makes the pharynx and the larynx irritable with the result that after an anæsthetic there is a good deal of mucous secretion

necessitating coughing. The act of coughing is felt in the perineum and after an operation for piles causes a great deal of unnecessary pain. The colon should be thoroughly emptied by efficient purgatives and by lavage. Castor oil should never be administered prior to rectal operations because it is often followed by fecal impaction. A brisk purgative should be given which ensures thorough evacuation of the contents of the colon. For this purpose I find there is nothing more satisfactory than a pill consisting of

Calomel gr. 1  
Extracti colocynthis co. grs. iiii  
Extracti hyoscyami gr. 1

In my private practice I employ the following scheme of preparation.

*First day.* The patient is kept in bed on a light diet. He is not permitted to smoke or take alcohol. At 10 p.m. he is given two five grain aperient pills.

*Second day.* Early in the morning he is given a saline draught such as a Seidlitz powder or an equivalent followed by a cup of hot tea. After the bowels have acted a plain water enema (1½ pint at a temperature of 70° F) should be administered for purposes of thoroughly emptying the colon. Light diet is allowed—no smoking or alcohol permitted. The patient should remain in bed. At 10 p.m. one aperient pill is administered.

*Third day or day of operation.* Early in the morning a saline draught should be given. If there has been a satisfactory action of the bowels it is not necessary to administer an enema but if the bowels are not inclined to act it is as well to stimulate them to action by that means. The perineum should then be thoroughly cleansed and the surface painted with picric acid solution. It is not necessary to shave the surrounding skin. A sterile dressing is then applied and kept in position by a suitable bandage.

No food of any kind is to be given during the four hours preceding the operation nor is smoking to be permitted.

*Operation.* The operation which has been selected is now proceeded with. Personally I prefer a ligature operation to all others. My own method of performing the operation by ligature is as follows.

The patient having been anesthetized is placed in the right lateral and semi prone position the following instruments are selected one ordinary scalpel one pair scissors (Salmon's pattern) three pairs pile forceps (author's pattern) three pairs pressure forceps small No. 16 plaited silk.

*First step* Existing piles are usually exposed to view by stretching the external sphincter but this is not necessary because the external sphincter does not require stretching. When a patient is under an anæsthetic a normal sphincter can be readily dilated without forcible stretching. It is the pecten band the pathological result of piles which limits dilatation. It is very difficult to stretch this band without tearing it and when torn blood is extravasated into the surrounding tissue. The extravasated blood if considerable may end in suppuration or may eventually become fibrous tissue which still further limits dilatation. Stretching the pecten band even to partial tearing does not afford adequate exposure of the piles.

Therefore I always divide the pecten band with the knife. To do this the index finger of the left hand is passed into the anal canal and its lower margin is everted. The mucocutaneous junction is then divided by a short linear radiating incision in the right posterior quadrant. The pecten band which is quite superficial is easily recognized by its pearl white appearance. When the band has been completely divided the muscular fibers of the external sphincter come into view and should on no account be divided. As soon as the division of the pecten band has been completed the external sphincter can be dilated with ease and the exposure of all existing piles is immediately complete.

*Second step* A pair of pressure forceps is then placed on the skin at the anal margin at each of the points in the anal circumference which correspond to the position of the primary piles viz at the right anterior at the right posterior and at the left points. Slight traction on these forceps at once brings the primary piles in view when the stage of development of each can be ascertained. The presence or absence of secondary piles is also then determined.

*Third step* The pile forceps are now placed on the piles. The right anterior pile is always discreet and needs a pair to itself. This pile extends furthest up the rectum so should be seized first care being taken to grasp it as high up as possible. The right posterior pile is next dealt with. It should be remembered that two secondary piles are developed in connection with this one so that when present they should be included in the forceps. Finally the left pile is taken together with the secondary piles developed in connection with it namely the left posterior and the left anterior when they are present.

Thus it will be seen that even when seven piles are present they can be manipulated in to three groups so that only three ligatures need be used.

*Fourth step* A V shaped flap of the skin of the anal margin is then raised at the base of each primary pile in succession commencing with the right anterior and ending with the left. The base of the V is at the mucocutaneous junction. A ligature is then placed in the groove cut by raising this flap and is tied tightly as high up the pile as possible. When the three ligatures have been applied their ends should be cut short.

*Fifth step* The index finger is then passed into the anal canal to free the lumen which has been somewhat constricted by the application of the three ligatures and then the strangulated piles are returned into the anal canal. The lower ends of the ligatured piles should not be cut away first because the stump might slip through the ligature and give rise to serious hemorrhage and second because even if actual slipping does not take place the escape of blood from the tissue of the ligatured pile may cause the pedicle to shrink. When this happens strangulation is no longer complete and the central portion of the pedicle remains viable with the result that after the pile slough has separated the viable portion remains as a small fibrous polypus which is apt to increase in size and give rise to subsequent trouble. Finally a small pledget of cotton wool soaked in perchloride of mercury solution (1:500) is introduced into the anal canal and an external dressing applied.

*After treatment* Upon the manner in which after treatment is carried out depends much of the success of the operation. A good operation may be completely spoiled by carelessness in after treatment.

1. An operation for internal piles is attended by a great deal of after pain. As soon as the patient begins to recover from the anæsthetic he will be conscious of pain in the anal region. This pain increases in severity during the first six hours after which it gradually subsides and practically disappears at the end of 24 hours after the operation. If the patient becomes very restless and loses control of himself during the first six hours the pain may be kept up indefinitely. It is important therefore that steps be taken to relieve pain as soon as possible. For this purpose a hypodermic injection of  $\frac{1}{4}$  grain of morphia should be administered as soon as the patient has returned to bed. A sedative mixture containing opium should then be given at definite intervals with the object of helping to relieve pain and of preventing the bowels from acting. The following prescription will be found to be useful for this purpose viz

Liquor ammoniac acetatis 30 minims  
Tinctura catechu 30 minims  
Tinctura opii 30 minims  
Tinctura cardamom co 60 minims  
Spiritus chloroformi 10 minims  
Ex aqua cinnam mi to one ounce

The first dose of this mixture should be given 4 hours after the hypodermic injection and should be repeated at the following intervals every four hours during the first 24 hours every 6 hours during the second 24 hours every 8 hours during the third and fourth 24 hours until bedtime on the night of the fourth day (reckoning the day of the operation as the first day) when two 5 grain aperient pills will be given. The sedative mixture is to be discontinued after the pills have been taken.

On the morning of the fifth day a strong dose of sulphate of magnesia or a Seidlitz powder is administered to ensure that the bowels act thoroughly. Unless the aperient is strong enough to produce a fluid evacuation the process of defæcation will be extremely painful and the patient will be inclined to refrain from allowing the bowels to act in

future with the probable result that he will get an impaction of fæces. Throughout the remainder of the after treatment a mild aperient should be given every night to ensure a free action of the bowels taking place every day.

On the ninth or tenth day after the operation the pile sloughs will have separated. These usually come away quite painlessly with the motions without bleeding. In the event of a ligature remaining adherent beyond this period it can readily be detached by slight traction.

On the twelfth day after the operation the index finger should be introduced into the anal canal primarily to ascertain whether all the sloughs have separated and secondarily to smooth out the resulting granulating surfaces. Such digital exploration should be carried out every day until the wounds have healed an event which takes place on the nineteenth day on an average. The object of the introduction of the finger is to prevent the granulating surfaces adhering together and so leading to some degree of stenosis of the anal canal. If the finger be passed daily stenosis cannot possibly occur. During the after treatment the patient must be kept in bed until the fifteenth day when he may be allowed to get up. On the nineteenth day the pile wounds will have healed and on the twenty first day the patient may be allowed to proceed to his home.

*Diet during the after treatment* During the first four days that is to say while the bowels are being confined the diet should consist chiefly of fluids e.g. tea, milk and soda, beef tea and toast. No meat or vegetables should be allowed during this period. As soon as the bowels have acted freely on the morning of the fifth day ordinary diet may be resumed.

*Change of dressings* All external dressings are to be changed every morning and evening and in addition after each action of the bowels. The perianal skin should be carefully cleansed before the dressings are adjusted. The pledget of cotton wool which was introduced into the anal canal at the operation need not be touched as it will come away readily when the bowels act.

*Victoriation after operation* After an operation for piles spasm of the sphincter muscle of the urinary bladder persists for about 20 hours. During this period therefore the patient should not attempt to pass urine if he does he will probably not be able to do so and the straining to void urine will prolong the period of spasm necessitating eventually the use of a catheter which should be avoided if possible. During this 20 hour period therefore it is important that the patient should not be allowed much fluid to drink.

At the expiration of 20 hours all spasm will have passed off and he will be able to void urine quite naturally more especially if he is allowed to stand up for the purpose.

*Results of the operation* This method of operating yields 100 per cent of successful results. I have performed over 5,000 operations in this way with uniform success. The advantages of the operation are three fold namely (1) the loss of blood during the operation is trivial (2) the time occupied during its performance is short about three minutes (3) adenomatous tag of anal skin are not left behind.

In the majority of cases beyond the fact that a triadrite scar resulting from the removal of the three V shaped skin flaps remains the anus has a perfectly normal appearance.

#### RECURRENT AFTER OPERATION

If an internal pile be completely removed it cannot possibly recur. If a patient who has undergone an operation for internal piles develop symptom at some subsequent time one of two things has happened either the piles which were existent at the time of the operation were not completely removed or other have subsequently been developed which did not exist when the operation was performed. From my experience of many thousand of cases the following rule appears to hold good. If a patient need an operation for internal piles before he has attained the age of 30 he may not by that time have developed all the piles from which he is liable to suffer. As only piles which exist can be removed the operation cannot prevent the

remaining ones from developing. I have seen this happen over and over again after an interval of from 10 to 15 years. Among my records I have many cases of the following kind.

I performed an operation and noted that I had removed the right anterior the right posterior and the left internal piles. After an interval varying from 10 to 15 years the same patient again presented himself with symptoms of piles. On examination it was found that the posterior and the left anterior piles were present and were the cause of the symptom. It was obviously not a case of recurrence but one of subsequent development of piles which did not previously exist. If however a patient has reached the age of 40 at that time of life he will have developed all the piles he is ever likely to develop and therefore if the existing ones are completely removed he will never need a second operation. It follows therefore from the above observations that an operation for internal piles in a patient under 30 years of age confers immunity for 10 to 15 years only whereas one performed after the age of 40 years is a permanent cure provided that it has been efficiently performed. This law is not peculiar to operations performed by the ligature method. It holds good for all methods. Among my records there are several examples of re-development of piles in those who were operated upon by Whitehead's method before the age of 30 years.

#### CAUSES OF FAILURE

An operation for internal piles should show 100 per cent of cures. Failure to achieve such a result is due partly to the selection of an operation which carries with it a certain percentage of failures partly to faulty technique on the part of the surgeon and partly to curele after treatment. Apart from these however a knowledge of the different stages in the development of piles of their definite position in relation to the circumference of the anal canal and of a satisfactory method of obtaining complete exposure of all existing pile will go a long way to enable the surgeon to secure a good result by assisting him in the attainment of thoroughness in technique.

## DEPARTMENT OF TECHNIQUE

# THE PERMANENT CURE OF INGUINAL AND FEMORAL HERNIA<sup>1</sup>

### A MODIFICATION OF THE STANDARD OPERATIVE PROCEDURES

B. C. I. A. U. I. A. R. O. O. U. E. M. D. I. A. C. S. RICHMOND VIRGINIA

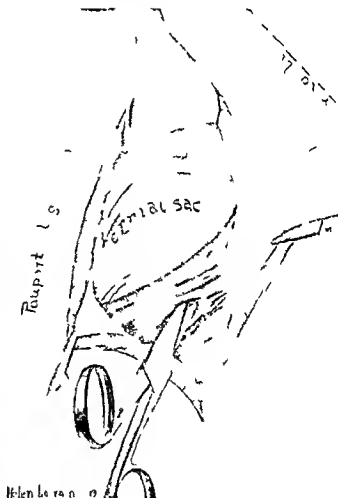
THE importance of standardization of methods in operative surgery is sufficiently obvious to need no emphasis. Within the past twenty years permanent cures of inguinal hernia following operation at the hands of good surgeons in proper hospital have increased to between 90 and 95 per cent of all cases operated upon. These improvements are due largely to more widely diffused comprehension of the purposes to be accomplished by operative treatment and to the standardization of methods of operative procedure. So long however as the standard methods of operating for hernia by qualified surgeons shall fail to cure 10 or 1 per cent of cases, surgical efficiency is less than 100 per cent perfect and it is desirable to make improvements upon even the standard methods of procedure. After all standard methods are only the best by test of available methods. No method is better than its results and these are not best if they can be made any better.

However other accomplishments may be necessary as a part of an operation designed to cure abdominal hernia the belief is quite standardized that removal or at least permanent separation from the peritoneal cavity of the entire hernial sac including its neck is essential.

The method herein illustrated is offered as a modification of the standard operative procedures employed for the cure of inguinal and femoral hernia. I would state plainly that the procedures are advocated and intended solely as a modification of technique not to supplant but to supplement the standard methods already employed. The advantages will be quite apparent by a careful study of the illustrations and may be briefly summarized as follows:

The general peritoneal cavity is opened well above the hernia and exploration carefully made

The entire operation is open the structures are in good view and all operative work is under constant guidance of the eye.



f g a Th u ual ine on th ugl kin ujerf cal  
 f c anlap eu o i c e th u g u n l cana c n  
 trun g the lie al ac a i c rd With lunt force s c n  
 sci s iert dlet en th mu cle bun lie f the inte l  
 olqu a l of the trn e i l and it fa c i t ut n  
 ineb ab their l r marg the lun l are parit d  
 in the u i mu c plitng fa h on mak g a goo l  
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*Urination after operation* After an operation for piles spasm of the sphincter muscle of the urinary bladder persists for about 24 hours. During this period therefore the patient should not attempt to pass urine. If he does he will probably not be able to do so and the straining to void urine will prolong the period of spasm necessitating eventually the use of a catheter which should be avoided if possible. During this 24 hour period therefore it is important that the patient should not be allowed much fluid to drink.

At the expiration of 24 hours all pain will have passed off and he will be able to void urine quite naturally in the especially if he is allowed to sit and up for the purpose.

*Results of the operation* The method of operating yields 100 per cent of successful result. I have performed over 5000 operations in this way with uniform success. The advantages of the operation are three fold namely (1) the loss of blood during the operation is trivial (2) the time occupied during its performance is short about three minutes (3) oedematous tissue of anal skin are not left behind.

In the majority of cases beyond the fact that a triadate scar resulting from the removal of the three V shaped skin flaps remain the anus has a perfectly normal appearance.

#### RECURRENT AFTER OPERATION

If an internal pile be completely removed it cannot possibly recur. If a patient who has undergone an operation for internal piles develop symptoms at some subsequent time one of two things has happened either the piles which were existent at the time of the operation were not completely removed or other have subsequently been developed which did not exist when the operation was performed. From my experience of many thousands of cases the following rule appears to hold good. If a patient needs an operation for internal piles before he has attained the age of 30 he may not by that time have developed all the pile from which he is liable to suffer. As only piles which exist can be removed the operation cannot prevent the

remaining ones from developing. I have seen this happen over and over again after an interval of from 10 to 15 years. Among my records I have many cases of the following kind.

I performed an operation and noted that I had removed the right anterior the right posterior and the left internal piles. After an interval varying from 10 to 15 years the same patient again presented himself with symptoms of piles. On examination it was found that the posterior and the left anterior piles were present and were the cause of the symptoms. It was obviously not a case of recurrence but one of subsequent development of piles which did not previously exist. However a patient has reached the age of 40 at that time of life he will have developed all the piles he is ever likely to develop and therefore if the existing ones are completely removed he will never need a second operation. It follows therefore from the above observations that an operation for internal piles in a patient under 30 years of age cements immunity for 10 to 15 years only whereas one performed after the age of 40 years is a permanent cure provided that it has been efficiently performed. The law is not peculiar to operations performed by the ligature method. It holds good for all methods. Among my record there are several examples of re-development of piles in those who were operated upon by Whitehead's method before the age of 30 years.

#### CAUSES OF FAILURE

An operation for internal piles should show 100 per cent of cures. Failure to achieve such a result is due partly to the selection of an operation which carries with it a certain percentage of failure partly to faulty technique on the part of the surgeon and partly to careless after treatment. Apart from these however I know of no knowledge of the different stages in the development of piles of their definite position in relation to the circumference of the anal canal and of a satisfactory method of obtaining complete exposure of all existing piles will go a long way to enable the surgeon to secure a good result by assisting him in the attainment of thoroughness in technique.

# DEPARTMENT OF TECHNIQUE

## THE PERMANENT CURE OF INGUINAL AND FEMORAL HERNIA<sup>1</sup>

A MODIFICATION OF THE STANDARD OPERATIVE PROCEDURES

PAUL G. PAULI, M.D., F.A.C.S., RICHMOND, VIRGINIA

THE importance of standardization of methods in operative surgery is sufficiently obvious to need no emphasis. Within the past 10 years permanent cures of inguinal hernia following operation at the hands of good surgeons in proper hospitals have increased to between 90 and 95 per cent of all cases operated upon. The improvements are due largely to more widely diffused comprehension of the purposes to be accomplished by operative treatment and to the standardization of methods of operative procedure. So long, however, as the standard methods of operating for hernia by qualified surgeons shall fail to cure 10 or 1 per cent of cases, surgical efficiency is less than 100 per cent perfect and it is desirable to make improvements upon even the standard method of procedure. After all, standard methods are only the best by test of available method. No method is better than its results and these are not best if they can be made any better.

Whatever other accomplishments may be necessary as a part of an operation designed to cure abdominal hernia, the belief is quite standardized that removal or at least permanent separation from the peritoneal cavity of the entire hernial sac, including its neck, is essential.

The method herein illustrated is offered as a modification of the standard operative procedures employed for the cure of inguinal and femoral hernia. I would state plainly that the procedures are advocated and intended solely as a modification of technique, not to supplant but to supplement the standard methods already employed. The advantage will be quite apparent by a careful study of the illustrations and may be briefly summarized as follows:

1. The general peritoneal cavity is opened well above the hernia and exploration carefully made.

The entire operation is open; the structures are in good view and all operative work is under constant guidance of the eye.

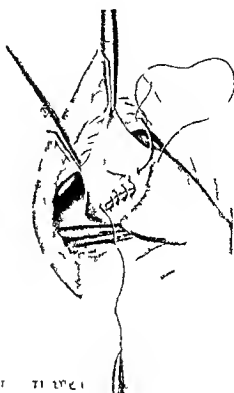


The usual incision through the superficial fascia is replaced by an incision in the inguinal canal. With blunt forceps or a sharp instrument, the muscle bundle of the internal oblique of the transverse abdominal wall is separated from the inguinal ring, splitting the inguinal ring, a good exposure of the hernial sac is obtained. The neck of the sac is then closed with sutures. The arching position of the internal oblique and transverse abdominal wall may be maintained by a suture placed in the neck of the sac. The position of the inguinal canal is then checked and opened in the usual manner.

P. G. PAULI, M.D., F.A.C.S., RICHMOND, VIRGINIA



Fig



F 3



Fig 4

Fig 5. Th t f th l t m ll t  
 th k f th h m d f t d th  
 k f th h d q t ly po f m th th  
 g l p t t t Adh t b l l m t m  
 mpl t ly d ly m d d f l pl t  
 f th g f th bd m m d  
 Fg 4. Th t f m ll h d  
 e p lly h th p f th h p t f m  
 pe t p pl g pe f m d th h m  
 t th th f th m y b tghtly t d  
 th d d t t m th g t k p d  
 t ht d by t th f t l th m ll  
 b l f ly l ft  
 Fg 4. Th t f m b th gh th  
 th p t l t t th p m t y  
 d m l t l t f th f m th p m t  
 c d bl dd d l g l l o l f m h high  
 l t th d ly mpl h d l l t f  
 mpty f m b l Th f l dd d f d  
 th t t t t l pl i th  
 d l t ly p t t d t j r v

3 Constricted and adherent bowel and omentum are safely and easily removed from the hernia and structure in the region and all bleeding points securely ligated

4 Coincident pathology of the bowel, the appendix and pelvic organ may be recognized and dealt with through the same or a separate incision at the time the operation for hernia is performed

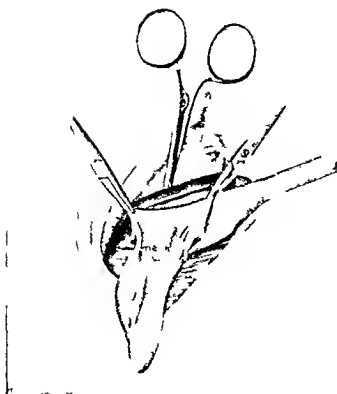


Fig 5

Fig 5 With forceps introduced from the outside against the hinge within at the lowest position of the sac it is pulled upwards and turned inside out into the peritoneal cavity and through the primary incision in the abdominal wall. The sac and contents of the cord and bladder are all the time in good view and easily protected against injury.

Fig 6 With the sac and redundant peritoneum in the region pulled well up and the bladder and its contents well exposed, sutures are placed in the peritoneum well above the neck of the sac and to the upper edge of the orifice in the peritoneal cavity. By thus placing the sutures an inch or so above the neck of the sac a high level of the sac and redundant peritoneum in the region is insured.

Fig 7 The uterus completely obliterates the internal ring and lifts the protruding portion of the permatocoele above and external to its original location in the inguinal region. The sutures should also include a small portion of the transversalis fascia which has been incised with the sac. The hernia is small in size in which the amount of tissue in the sac is the same as may be also to remain after ligation and the peritoneal suture above them.

5 The bladder, bowel, vas deferens, large vessel and other structures in the region of the hernia are under constant inspection and adequate protection against injury.

6 Loculation of the sac, sliding and other anomalous forms of hernia are promptly and immediately recognized and properly treated.

7 Enucleation and removal of the entire sac including the redundant peritoneum in the region



Fig 6

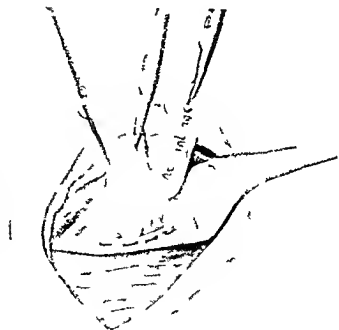


Fig 7



## SUSPENSION OF THE UTERUS WITH A STRIP OF FASCIA LATA IN THE TREATMENT OF PROLAPSUS<sup>1</sup>

BY LEONARD FREEMAN, M.D., F.A.C.S., DENVER, COLORADO

THE following method of operating for complete prolapse of the uterus although it may not be entirely new, has not been widely employed or accurately formulated.

*Operative technique.* Having obtained access to the abdominal cavity through a median suprapubic incision of sufficient size the uterus is brought up into the opening and inspected. If the patient is still within the childbearing period she must be sterilized by ligation of the tube with silk dividing them and perhaps folding the severed ends upon themselves.

A strip of fascia lata about six inches in length and three-fourths inch in width is then obtained from the outer side of one of the thighs in the following manner. An incision of sufficient length is made through the skin and subcutaneous fat directly down to but not through the glistering white fascia, and extending along the lateral aspect of the limb midway between the trochanter and the knee. With a gauze covered finger the adipose tissue is pushed to either side so as to clear the field and the fascia divided in two parallel lines of the required length. The strip is then loosened and elevated by slipping the handle of a scalpel beneath it and sweeping the instrument from one end to the other. After dividing the attached ends with scissors the strip is removed and enveloped in moist gauze until required. The slit in the fascia lata from which the graft was taken may then be closed with a running suture of chromic gut although this is not absolutely necessary because no harm will result if it is not done.

Returning to the abdomen the uterus is held firmly while a closed pair of small sharp pointed curved hemostatic forceps is plunged from one side to the other directly through the substance of the uterus close beneath the peritoneum covering the fundus but not penetrating into the cavity—a pair of small alligator forceps is well adapted to the purpose (Fig. 1). The forceps should be entered just internal to the attachment of one of the tube and brought out at a corresponding point upon the opposite side although if the organ is large it may be well to tunnel it somewhat more anteriorly in order to prevent undue pressure upon the bladder when the uterus is suspended from the tendon of

the recti muscles. In order to facilitate the insertion of the forceps it is occasionally desirable to nick the peritoneum with the point of a knife.

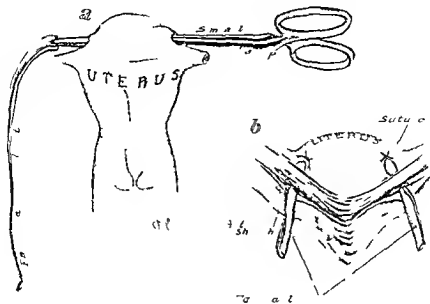
When the forceps have been passed and are still in position the fascia is doubled longitudinally upon itself one end seized in the jaws of the instrument and the strip dragged through so that its center rests in the middle of the tunnel and its loose ends project from either side (see illustration). Catgut sutures are then inserted so as to close the openings of the tunnel thus preventing oozing and holding the fascia in place.

The next step is to secure the ends of the fascia around the tendinous insertions of the recti muscles in order to bind the fundus of the uterus securely and closely to the anterior abdominal wall. This is accomplished first by stripping back the anterior sheaths of the muscle for a short distance above the pubes so as to uncover the tendon and plunging through these and the underlying peritoneum from without inward a pair of pointed hemostatic forceps with which the ends of the fascial strip are seized and dragged into place one on either side of the abdominal incision (Fig. 1 b).

After the peritoneum is closed the ends of the fascial strip which have been returned in forceps to prevent retraction are pulled tight enough to hold the uterus firmly against the abdominal wall and are then crossed over the median line best by tying them in a half knot and stitched securely to each other in several places by means of chromic gut so that they cannot slip. The wound is then closed in layers. Additional security against slipping may be obtained by catching the end of the suspending fascia in the bight of a figure of eight silkworm gut suture used in closing the abdominal incision.

*Fascia lata* has a number of things in its favor: (1) It is easy to obtain in any desired quantity. (2) It is very strong and will not stretch to an appreciable extent thus differing from the natural supporting ligaments of the uterus. (3) It does not become absorbed like catgut but incorporates itself within the tissues and permanently holds the uterus where it is placed.

Strip of fascia from the sheaths of the abdominal recti have been employed to suspend



D g b g th t l q

the cervical stump of a prolapsed uterus following a preliminary hysterectomy. But this is not as satisfactory as the use of fascia lata in the manner described because enough material of sufficient strength is not easy to obtain and there is danger of infection from the cervical canal to say nothing of the ulcerations and danger of removal of the uterus.

During the last few years I have operated upon 11 cases according to the above technique, the first being done on February 11, 1914. There has been no mortality. At the time of checking up the results all were relieved of their prolapsus although two were operated upon too recently to be able to speak with certainty of the final outcome.

1914

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|------|------|-----|--------|
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| Well | t th | d f | 3 y    |
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| Well | t th | d f | 6 m th |
| Well | t th | d f | 3 m th |
| Well | t th | d f | 6 m th |

Several of the cases have developed ventral hernias. Although it does not seem probable that the operative procedure has much if any thing to do with this nevertheless it may be well to exercise special care in the closure of the abdominal wound.

C U C H T W S A p

One case was particularly instructive because of the opportunity afforded for checking up the internal abdominal condition. At the end of a year it became necessary to operate for a ventral hernia. The uterine fundus was found firmly held in broad apposition against the anterior abdominal wall just as it had been placed originally and the trip of fascia lata could still be detected more or less incorporated in the tissues as it had fused out of the substance of the uterus on either side.

Another case also deserves attention. For certain reasons a badly torn perineum and a fairly large vulvovaginitis were not repaired when the uterus was suspended. Although the suspension partly corrected the cystocele nevertheless at the end of about a year it had increased somewhat in size while the uterus itself remained firmly in position in spite of the lack of support from below.

From this experience as well as from general consideration it is undoubtedly wise to attend carefully to all vaginal repair work even though it may seem superfluous when the uterus is first suspended.

When we have at our disposal so simple and reliable a procedure as the one just described it would seem unnecessary in most instances to consider the more complicated and sometime more dangerous operations for prolapsus such as hysterectomy, the vaginal operation of Wat-

kings the Murphy operation and the burial of the entire uterus within the anterior abdominal wall. In addition to their comparative gravity these methods are by no means always successful as most surgeons have had cause to appre-

ciate if they have operated upon many bad cases of uterine prolapsus. In comparison with the advantages of fascial suspension a linear scar upon the lateral aspect of the thigh is of minor importance.

## A FENESTRATED BAND IN FRACTURES OF BONE

By ASA W. COLLINS, M.D., SAN FRANCISCO  
Ch 15 g. Fr. 111 pt 1

**I**N bone fractures the prime factor in treatment is a restoration of normal function and this depends on securing proper apposition and its maintenance. Method vies with technical skill in the pursuit of this result. The sum of desired results may be considered almost wholly in reference to apposition and the maintenance of apposition until perfect functional and cosmetic results are secured.

Very happily the treatment is not often difficult and the results are excellent in the great majority of uncomplicated fractures of the long bones, but it is in the consideration of the exceptional case that we are now concerned for it is here that the resources of the surgeon are not infrequently taxed to the uttermost.

The variety of external splints and appliances even before the great war would seem to have served every possible aid in this regard but notwithstanding this apparent completeness of applied mechanics war surgery has made still further additions to our armamentarium and yet the art of fracture treatment would seem from time to time to call on the future for further modification.

In the treatment of fractures of the long bones I nearly always try reduction and the application of a cast. If the X-ray shows an unsatisfactory result a second attempt is sometimes made then if unsuccessful operative methods are instituted.

At the operation reduction is accomplished and if the line of fracture is transverse and the edges well serrated the tendency will be for them to remain in good position until a cast can be applied and no mechanical appliances are necessary. If however we find that the open reduction method alone will not suffice then it becomes necessary to resort to the application of some internal splint directly to the bone.

Most surgeons are quite familiar with the use

of the Lane plate, staple, silver wire, kangaroo tendon and Parham band as well as the bone graft and dowel in operation for the adjustment of fragments in fractures. The object of this paper is to add one more appliance to this list consisting of a fenestrated band and an instrument for its application which I have devised and used for the past three years.

This fenestrated band is used in cases which are most apt to prove unsatisfactory with the ordinary methods to wit:

1. Cases with V shaped fracture the V forming a loose fragment between the two ends.
2. Long oblique fracture.
3. Comminuted fractures where we wish to bring a number of fragments into apposition.

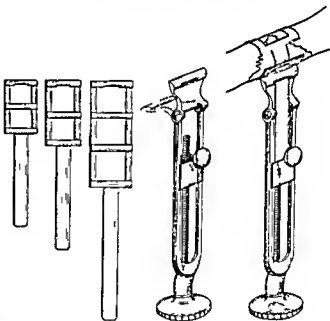


Fig. 1 (at left) Band ready for application.  
Fig. 2 and 3. Instrument used to tighten band by turning screw on the end of the band. When tight the band is locked by pulling on the instrument which bends the tongue of the band upon itself.





femur where the band was first successfully used with an almost complete restoration of function and in this case no other splint could possibly have been used with a like advantage for the reason that the band accommodated itself to the uneven diameter of the bone and the fragments were thus drawn into the proper position.

It is of course essential that the bands should be made of a ductile metal. For this purpose an alloy of nickel and silver seems to promise the best results having already been proved to be quite satisfactory. Where the bands are to remain in the tissues we assume that a greater percentage of nickel would be desirable for the reason that nickel seems to be better tolerated by the tissues than any other metal. The bands are being cut out of 4 gauge plate and the cross

bars reinforced by a piece of the same thickness which gives the cross-bars twice the strength of the side bands.

For the last six months only one size band has been used in all cases and this band has but one window in it. It has been so satisfactory that I believe the future will show us that one size band will meet all cases.

In favor of this design of band I can state that the time consumed in its application takes but a few minutes, the approximation of the fragments is greater than is possible with any other method and the application is quite simple. I am not offering anything radically new but a device which surgeons with considerable experience in bone work will recognize as a valuable addition to appliances for operative treatment of fractures.

## CONTROL OF HÆMORRHAGE IN TONSILLECTOMIES

By WILLIAM R. PARKES, PH.D., M.D., I.A.C.S., CHICAGO, ILLINOIS

Accepted for publication May 11, 1911

THAT control of hemorrhage has greatly disturbed every surgeon attempting tonsillectomies can scarcely be denied. Many general surgeons, brilliant operators in difficult fields, have given up removing tonsils because of the difficulty encountered in controlling bleeding.

I have devised a very simple method that has never failed me in my last hundred tonsillectomies. To my knowledge the method has not been described and because of its simplicity and efficiency I venture a brief description of the procedure.

But two instruments are needed viz. two 6 inch hæmostats, one curved and one straight. The straight forceps is armed with a catgut ligature about 12 inches long held at the very tip of the forceps.

The curved hæmostat is applied to the bleeding vessel usually found back of the arch of the tonsil pillars. The forceps is now turned about 180 degrees so as to free its point from the surrounding tissue and facilitate the application of the ligature. It is held in this position by an assistant.

The straight forceps armed with the ligature is taken in the right hand, one end of the ligature being held in the left. With the aid of the straight forceps the ligature is passed around the curved forceps easily hooking the ligature over the

point of the forceps. It should be observed that this is done not by the finger but by the forceps which holds the ligature by its very tip.

While the left hand holds the ligature taut the straight forceps still holding the tip of ligature is withdrawn from the mouth so the knot can be started outside the mouth. The knot can be easily tightened around the vessel and the curved forceps readily removed from the bleeder, the tip of the curved forceps never being caught in the ligature. The knot is completed and the ligature cut short. This is all done in less than half the time it takes to tell it and one can now leave the patient and as Deaver says "sleep all night with never a thought of danger of hemorrhage." I have never found it necessary to tie more than two bleeding points in one tonsil bed and rarely more than one.

With the prevention of bleeding there is less swallowing of blood, less prostration and less nausea. The method therefore adds greatly to the comfort and safety of the patient to say nothing of the peace of mind of the operator.

This method of application of a ligature is adapted not only to tonsil vessels but to any deep bleeding point not easily accessible to the finger tips. In fact it was in connection with cystic duct vessel and pelvic bleeder that I first used it.



# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING MAY 16 1919 WITH THE PRESIDENT DR N SPROAT HEANEY IN THE CHAIR

### PARASITIC MONSTER

DR ERNEST J FORD Evanston Illinois Young woman age 19 robust individual in the best of health At normal delivery a healthy child was born October 30 1917

On January 1 1919 when the patient was pregnant 6 months and 22 days I was called and I found her suffering severe pain over the gall bladder region I administered hypodermically  $\frac{1}{4}$  grains morphine She did not seem unusually large and I felt she probably had gall stones complicating her pregnancy At 10 a m the next day I found her having regular labor pains and she was immediately admitted to the Evanston Maternity Hospital at 11 45 a m the membranes ruptured at 11 50 a m and a copious amount of amniotic fluid (gallons) expelled at 11 58 a m a baby girl was born which is the specimen we have at 1 20 p m spontaneous expulsion of placenta

Mall gives a series of over 400 abortions and a little over 50 per cent of those were pathological He also quotes from Williams that every fifth to sixth pregnancy ends in abortion Marschand has given statistics that in 8118 births 615 were monsters From these figures Mall has worked out the following tables of 100 000 pregnancies 80 per cent resulted in normal children and 1 per cent in apparently normal abortions 7 per cent in pathological abortions and 6 per cent in monsters He points out that there is a great diminution in pathological abortions after the eighth week In other words the embryos with excessive radical changes generally aborted while those less severely affected resulted in monsters For instance cases of spina bifida anencephaly cleft palate and ectopia have been diagnosed by Hs in embryos less than eight weeks old As to the causes of these pathological ova and monsters Mall lays great stress on malnutrition He also says that in most of the pathological ova the chorionic villi are abnormal

This monster is of a very rare type According to Hirst's and Piersoll's classifications it would come under double parasitic monsters the epignathus group Ahlfeld reports 40 such cases He places in this same group several in which the fetus grew from the orbit but none from the nose Hirst and Piersoll mention one case of a teratoma projecting from the nares Ahlfeld offers the possible explanation of two embryonal axes close to

gether in a straight line on a single egg they are head to head so that as they develop the stronger overlaps and ultimately destroys the weaker

### DISCUSSION

DR N SPROAT HEANEY This is a most unusual case I would like to speak about the frequency with which hydramnios is associated with monstrosities In the ordinary monstrosities like spina bifida we see some relationship between the foetal monstrosity and its association with hydramnios In this case there is no reason why this sort of monstrosity should be so associated yet we all know when we find hydramnios we are liable to have malformation of the foetus There must be some relation between monstrosities and hydramnios that is not apparent to us

DR DORLAND Was there a Wassermann made of the mother?

DR FORD No

DR DORLAND Did it spring from the nose or the jaw?

DR FORD The nose

DR HENRY F LEWIS What about the other children?

DR FORD The first child was healthy and delivery was normal

DR WILLIAM C DANFORTH I saw a case of hydramnios the woman was eight months and had a very large amount of fluid I made a diagnosis of possible monster The delivery of the child was perfectly normal except the abdomen was greatly distended and then a diagnosis was made of congenital cystic kidney The child however did not have a congenital cystic kidney but a congenital stricture of the bowel a portion of the ileum being greatly distended The rectum was much smaller than the small bowel about as large as a lead pencil the greatly distended portion being filled with meconium No hemorrhage occurred I have never seen anything like this case reported by Dr Ford

DR GUSTAV KOLISCHER read a paper entitled Inference in Tumors of the Female Bladder Their Indications and Technique

### THE USE OF A SEMILUNAR PAD WITH CORSET FOR THE RELIEF OF VISCEROPTOSIS

DR MILTON M PORTIS Visceroptosis enteroptosis or splanchnoptosis is Glenard's disease a disease known by all these names is an old subject

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health so far as rest and food are concerned. We should urge them to seek a kind of occupation mental and physical which is compatible with their limitations. That is a hard thing at times to estimate and still harder to carry out because of the financial condition of the patient. But there is no doubt that these cases are much more common in the well to do classes as opposed to the working classes. I do not see many patients with this condition around the Cook County Hospital but I see many of them at my office. Whether the physical work of the individual has something to do with muscular development or whether the congenital cases are few I do not know.

In a mechanical way to help these individuals many things have been suggested. I put a great many patients in the Rose bridge. I have tried things that an instrument maker made for me. I have tried various types of apparatus that all of you have had more or less experience with such as pneumatic pad and what not. I did not know how much I really accomplished. When I became the possessor of a fluoroscope I put patients under the fluoroscope machine both lean and fat and found the results were largely psychic. I was more or less disgusted. When I tried that out definitely with the X-ray knowing I had something definite with which to hold up the viscera I accomplished something. I tried out various types of corsets. The women objected to the corset made by the instrument makers because it did not look well it did not give them proper shape. In trying out various things suggested by the work of others several years ago I decided on a type of pad to be worn with a front laced corset. I do not claim originality for it although certain phases of it are original. The nurse takes measurements from the symphysis to the umbilicus and from the anterior superior crests of the ilium and then makes a pad as thick as told. The pad is made of a size dependent upon the grade of gastroptosis.

This semilunar pad should be lower at the bottom and thinned out. The excess pressure should be in the lower part of the abdomen.

When the corset is put on the patient is instructed to do so lying down with the hips elevated. She can put a pillow under the hips elevate the hips higher than the shoulders and strap the corset across.

I do not know how to estimate the psychic factor in these cases. Again I must emphasize the point that in all of these patients I try the fattening cure. As these patients gain in weight and feel better I take out half of the pad and later the entire pad and have them wear a front laced corset alone. They get whatever they need in a symptomatic and muscular way so it is possible that a part of the improvement they show depends on the diet I give them and on other measures rather than on the pad.

Just a word concerning the surgical treatment of visceroptosis. I have never been enthusiastic about the various operations on the stomach that a great

many of our surgeons have carried out nor have I been impressed very much with the types of suspending operations for the colon. However if I suffered from joint changes and pronounced toxemia and there was more or less impairment of vision due to the fact there was imperfect elimination of intestinal intoxication in a chemical sense I would not hesitate to submit myself to some type of operation which might repair or relieve this mechanical obstruction. If I was shown to have Jackson's membrane and it produced mechanical obstruction I would not hesitate to have an operation done but I do not think it is right to submit this type of patient to operations indiscriminately particularly when the diagnosis is not clear for by so doing we are very apt to convert a latent neurasthenic into a pronounced and active one.

#### DISCUSSION

DR CAREY CULBERTSON Dr Fortis paper has been extremely interesting to me because this is a subject that I have not given special attention to for years. I noticed years ago when working in the dispensary that many of the patients were suffering from abdominal ptosis and in that way became interested in the subject.

There are several points brought out by Dr Fortis that are quite in line with my own observations and I am sure with the observations of practically every man who has had to deal extensively with the complaints of women.

When he first stated that 5 per cent suffered from this condition I was surprised because that number is considerably in excess of the number that have come under my observation and in excess of the statistics with which I am acquainted.

Surely at the Cook County Hospital where we see so many women patients much less than one in four suffer from enteroptosis. At the same time it is true especially in a gynecological way at the County Hospital the majority of patients are young women who have not reached mid life. On the other hand in private practice in the office we see a larger percentage of women in whom we have reason to suspect and many times prove this condition.

Another point which he brought out is the relation of blood pressure to this underlying fault. I noticed this some years ago when working on blood pressure that there was a rather constant run of low blood pressures in women of the ptotic type. I regret Dr Fortis did not go into a little more detail with respect to that. I should like to ask if it has not been his observation that it is the systolic which drops in these cases rather than the diastolic pressure that is to say the diastolic pressure is not lowered in proportion to the lowering of the systolic pressure.

I agree with Dr Fortis with regard to the surgical treatment of these cases. When I was working in the dispensary we used postoperative maternity corsets and pads were put inside the front part for the treatment of ptosis. There is no question that









Thos Addis Emmet Esq

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## IN MEMORIAM\*

THOMAS ADDIS EMMET M D LL D

1828-1919

Dr J RIDDLE GOFFL M D F A C S NEW YORK

Ae atque Vale bold cion f a noble name  
And of a stock more royal than f kings  
Calm scholar s e b a e exemplar of things  
So plendh l that they m ck the sm le of fame

WITH each succeeding year one by one the great men fathers of our specialty are passing away. Today we are called upon to record with expressions of supreme respect admiration and love the departure of our oldest living member and Founder Dr Thomas Addis Emmet.

To the younger generation of rising gynecologists Dr Emmet may be nothing more than a name but to those who were associated with him in his plastic work and came under the charm of his clinical lectures the name Emmet will be an inspiration as long as working days shall last. By force of his own genius indomitable will and untiring energy he invaded an unexplored field of surgical work, elaborated his own system of pathology, devised original plastic procedures, invented instruments to meet new requirements and with the exception of laparotomy covered the whole range of gynecological surgery. He embodied this work in a volume entitled *The Principles and Practice of Gynecology* which appeared in 1849 and ran through three editions in fifteen months. All three editions

were reproduced in London and later the book was translated into the French and German languages. Dr Emmet described only his own work and the book was original from cover to cover.

Dr Emmet played a great part in the surgery of the nineteenth century, a pioneer in an unexplored field of surgery he had new problems to solve and difficulties to overcome but he had also results to achieve and he achieved them. The story of his life is a story full of fascination and inspiration.

Dr Emmet came of a long line of eminent men who were conspicuous in Irish history. He tells us that his grandfather Thomas Addis Emmet for whom he was undoubtedly named was a prominent physician in Dublin Ireland. His father John Patton Emmet was born in Ireland but emigrated to this country at an early age. His mother Mary Boyd Tucker was a native of Bermuda. Her family came from the county of Kent England. Thomas Addis was born May 9 1828 at the University of Virginia Charlottesville Virginia where his father was one of the original professors appointed by Thomas

Line from Edited by Dr Emmet by J C Lawson

Published by the American Gynecological Society at New York

Jefferson to fill the chair of natural history later assigned to chemistry and maternal medicine. His father in a letter describes Thomas Addison when born as a small delicate child but that he speedily became large plump and heavy and predicted that he would become eminent in music wit and poetry. As a boy however he had no taste for books music or poetry played truant constantly and spent much time roaming about the woods and hills with his gun—in the course of which if opportunity offered he would jump on the back of a razor back hog and holding on to both its ears take a John Gilpin like ride. He was fond of reading however and spent many hours with books of travel history scientific treatises and novels seeking and listening to explanations by his father who was ever ready to respond fully to his questions.

Through frequent visits to his uncle who lived on Second Avenue New York (then a fashionable district) he became familiar with the city and its surroundings and finally was sent to a famous private school at Flushing Long Island. After his father's death he entered the counting house of one of his uncles in New York but the life and work were not to his taste and after a brief experience he entered the University of Virginia. It soon developed that he had as little taste and inclination for the college class room as for the counting house. In great despair but in a moment of inspiration he thought of Dr. Dunglison of the Jefferson Medical College Philadelphia who had been a colleague of his father at the University of Virginia and a warm personal friend. He wrote to him asking his opinion as to the desirability of his trying to study medicine. His suggestion met with cordial approval. He hastened to Philadelphia and attended his first lecture delivered at Jefferson Medical College by J. K. Mitchell Professor of Theory and Practice of Medicine October 1846. From that hour Dr. Emmet writes "I felt my life's work was laid out for me. He had come from a family of physicians and had at last caught on to the family groove. He now got down to work and life assumed a more serious aspect. Dr. S. Weir Mitchell was a fellow student. Dr. Emmet received his medical diploma in

1848 and was commended for his thesis. On the *Original Circle of Nutrition*. Yet he says "I had dissected but a single muscle in the human body and graduated without having written a prescription or attended an obstetric case." He returned to New York and received the appointment of resident physician to the Emigrant Refuge Hospital on Ward's Island which was just completed and about to be opened for patients. He served in this capacity for three years having had in that time under his charge over 11,000 miscellaneous cases including eruptive fevers, ship fever, obstetrics and surgery. Upon the expiration of his service he was appointed visiting physician to the hospital and secretary of the board at a salary of four dollars a day on which together with a small increase from general practice he soon married.

In the spring of 1855 through a turn in politics he lost his position on Ward's Island. By mere accident he made the acquaintance at this time of J. Marion Sims. This incident proved the turning point in his career. Dr. Sims was a restless genius intolerant of restraint a skillful operator quick to comprehend every new condition or complication and ready to meet it insistent upon every detail but never did two operations exactly in the same way. The orderly regimen of a hospital irritated him and case histories and records were his *bebe noire*. He promptly recognized in Emmet the qualities of methodical work that had been developed during his service at the Emigrant Hospital in keeping the admission cards and case histories according to prescribed system and he selected him at once to become his assistant and associate in the Woman's Hospital.

During our joint service of five and a half years at the Woman's Hospital my relation with Dr. Sims was as close as that of a son. If he had not given us certain instruments which opened the way for investigation with his knowledge of suture wire and his perfect technique I should never have been known to the world in connection with gynecology.

Dr. Emmet was appointed assistant to the Woman's Hospital in 1855 and served in that

capacity carrying the whole burden and responsibility of the surgical work with the assistance of a resident surgeon and house staff for a period of ten years to 187. He personally kept most careful and accurate history of every case and illustrated the pathologic conditions and the operations with pen and ink drawings sometimes coloring them with tobacco juice and other pigments. These history books are still to be seen in the library of the hospital.

This was the period of his great and most productive work. Dr Sims in his vesicovaginal fistula achievement had attempted operation only on those cases in which the borders of the fistula could be readily approximated. Those in which the contractile scar tissue held the edges of the fistula widely apart were classed as inoperable and dismissed. Dr Emmet took up the study of these cases and by patient persistent effort devised ways and means of incising the adhesive bands and softening the scar tissue so that the edges of the open fistula could be finally approximated and closed. This was a great triumph. Ordinarily the formerly discarded cases were sent for submitted to the treatment and finally cured.

In 1868 he published his first medical work entitled *Vesicovaginal Fistula* containing the report of 600 cases. The difficulties encountered in denuding the edges of distorted and inaccessible fistula suggested scissors as a substitute for the knife. His mechanical ingenuity devised scissors with blades set at various angles to the shafts or curved in various arcs of circles. These facilitated the work and made possible his incomparable success. Dr Emmet asserts that the substitution of these scissors for the knife was his first contribution to surgery. The general surgeon of today recognizes the advantage of this device by carrying in his kit the successors of these famous scissors.

The extraordinary concentration of clinical material in the Woman's Hospital afforded rare opportunity for the study of manifold lesions. It was natural that fistula cases should present many and varied phases of lacerated cervix waterlogged and infected. These he studied with infinite patience and

assiduity till as a corollary to the fistula he found that by puncturing the diseased glands blood letting hot water douches and antiseptic stimulating applications he could reduce them all to the primary condition of simple or double laceration. Denudation of opposing surfaces and stitching them together with silver wire effected a cure. Thus he invented the operation of trichelorrhaphy which has played so great a part in the evolution of gynecology as a surgical specialty.

Thus also he reached the conclusion that the condition which had been universally accepted from the teachings of Dr Bennett of London as an *ulceration* had its origin in a *laceration* of the cervix. Out of this discovery he developed to a nicety of perfection his plastic operation of restoration of the cervix then known as trichelorrhaphy. This was a great discovery. It disclosed the fact that the origin of the condition was inherent in the laceration which exposed the tissues to an infection that otherwise they were ordinarily able to resist. This announcement paved the way for prophylaxis through immediate repair. And not only that it shed light on the frequency of epithelioma of the cervix and its prevention by the same prophylactic treatment. In the course of this treatment he put in practice and elaborated the intelligent use of the hot water vaginal douche. No single agent has probably ever given more relief to suffering women than the hot water douche when properly administered. As a hygienic measure it has met with universal adoption.

In the field of plastic work upon the perineum Dr Emmet essayed the butterfly denudation operation which many years pre dominated in restoration of the perineum especially in our own country. This underwent many modifications in his own hands and at the suggestion of many operators until with all its contemporaries it has dropped into innocuous desuetude to be superseded by the direct muscle stitching operation.

Dr Emmet exploited every field of plastic work within the range of the gynecologist studied its pathology devised operative procedures proved their efficiency and described them with a perfection of detail that made

them acceptable to every skilled operator. For all time all operators who do plastic gynecological surgery will be under permanent obligation to Dr Emmet. Undoubtedly he did more than any one man to put it on a scientific basis. All succeeding operations have been an evolution from his work. He founded a school of pathology of treatment and of operative technique that was individually his and he clung to its underlying principles to the end of his professional career.

Emmet was the pioneer that blazed the trail and opened the way for succeeding generations. But so ably have the new discoveries of science been applied to the principles he established that within his lifetime practically all the details in the application of his inventions have been modified some times beyond recognition or succeeded by more scientific and successful methods. Gone are his cellulitis theory, his trachelorrhaphy which he practically abandoned for amputation and now modified by the Sturmdorf operation, his perineorrhaphy, his traction and

amputation of fibroid tumors, his buttonhole in the bladder for the relief of cystitis by drainage and his operation for procidentia.

He lived to realize all this but fortunately his interest and thoughts had drifted away from medical and surgical themes and he found interest and enjoyment in reducing to writing and illustrating with great artistic effect his *Personal Reminiscences of a Long Life*. He evidently experienced what is known as second memory and all the details of his boyhood, his schooldays and life's experiences are told with the freshness of yesterday's enjoyment.

Dr Emmet showed his scholarly attainments in the clarity of his writings, the graphic word pictures of his operations, his pointed anecdote and his engaging conversation. As a patriot and a lover of his country, no loyalty could equal his zeal and devotion in perfecting the record of the signers of the American Declaration of Independence. Into this work he threw the same indomitable perseverance that brought him success in his surgical work.

THE TREATMENT OF CERTAIN CASES OF PLACENTA PRÆVIA BY CONSERVATIVE MEASURES<sup>1</sup>

BY STORGE W. KOSMAK, A.B., M.D., F.A.C.S., NEW YORK

Att. d. g. S. Geo. Es. 31 II p. 11

THE choice of a suitable topic for a paper to be presented to this Society was somewhat hampered by the restrictions imposed upon research work during the past year. Neither the desire to develop an original topic nor the means for carrying out the same were at hand during this period when the energies of those of us who did not enter the great struggle in a military capacity were concentrated on the relief of the civilian population. Our hospitals found themselves unable to do more than to merely care for patients—the lack of internes, nurses and other factors requiring the attention of the attending staff to duties that could formerly be relegated to others.

The unsolved problems of obstetrics are still far from few and in addition to new ones there are many of the older in which better results must be worked out from the purely clinical standpoint. Among these there is none that demands our attention more than the subject of placenta prævia on account of the deleterious effects of this complication on the mother as well as on the unborn child. In its extreme varieties it must be accounted as one of the most serious accidents of pregnancy and even in the less marked forms it constitutes a source of potential danger. The suddenness of the onset in totally unsuspected cases and the necessity for quick action calls forth an exercise of judgment on the part of the practitioner of obstetrics which is perhaps not equaled by any other demand in this field. The diagnosis once having been made what shall be the most satisfactory method of treatment? Shall we proceed in a radical fashion according to the recent dictates of several authors or shall we temporize, shall we disregard the interest of the baby entirely or shall we endeavor to save the same by a necessarily mutilating operation on the

mother? Since the perfection in methods of performing the abdominal cesarean section this has been widely advocated as one of the most satisfactory methods of relief in this condition and in a limited class of cases it is undoubtedly of value. The older measure involving the Braxton Hicks version with perforation of the placenta and the use of the fetal thigh as a tampon hardly seems a fair procedure in view of the certainties attending the classical cesarean section and is becoming generally discarded except in emergencies. The primary danger to the mother from hemorrhage and shock and the secondary risks from sepsis and embolism have been the deciding factors in selecting any method of treatment and all deliveries by the vaginal route are overshadowed by these possibilities. In primipara presenting a rigid and only slightly dilated cervix and the probability of a central placenta prævia with the child at or near term and still in good condition because the amount of bleeding has not been extreme there is no question but what the abdominal cesarean section offers the best method of delivery for both mother and fetus. But it will be found that the large majority of cases are outside of this group that we are not dealing with central implantations of the placenta but those in which merely a portion of this organ impinges upon the region of the internal os or the lower uterine segment so that hemorrhage of any extent results only after the cervix has become thoroughly softened and is dilating. Nevertheless even in this group the amount of bleeding may be sudden and excessive especially as the lower uterine segment in multipara in whom we most often find this abnormality is thoroughly softened and separates easily from the placenta.

As the first consideration in any given case is to stop the hemorrhage the vaginal pack seems to offer a ready solution especially

as its application is usually in emergency one. Unfortunately we find that in many cases admitted to our hospital in whom this procedure has been resorted to the blood saturates the substance of the gauze or absorbent cotton ordinarily employed and allows for the collection of large clots above the packing without control of the hemorrhage. The pack moreover acts as a stimulus to uterine contractions and as the membranes are often unruptured the presenting part is not satisfactorily forced down against the bleeding area in order that it may act as a check on the same.

The use of the elastic bag in place of the gauze pack has been widely advocated and unquestionably good results have followed its employment. The usual procedure directs the insertion of the bag through the ruptured bag of membranes or through the mass of the placenta with or without traction on the same to insure compression. In criticizing the mechanics of this procedure attention must be called to the fact that such compression of the bleeding area in the lower uterine segment is necessarily indirect because the soft placental mass remains interposed between the bag and the uterine wall and more or less continuous bleeding although only slight is usually present. In the attempt to introduce the bag it has been my experience at least that considerable bleeding may result from this effort because of the undue placental separation brought about by the same. We also find that if strong labor pains fail to be induced the bag is not firmly held against the placenta unless traction is applied and if the latter is not carefully guarded a sudden laceration or rupture of the lower uterine segment may take place.

In view of the shortcomings and the desire for a possibly more satisfactory method of treatment along these lines what modification of such method can be advocated as a substitute? It must be borne in mind that it is essential to bring about gradual dilatation of the cervix without laceration to reduce the possibility of hemorrhage as much as possible to avoid septic infection and of course to deliver a living child. Unfortunately the amount of bleeding which the

patient has undergone in most cases before any method of delivery can be applied results in a considerable degree of fetal asphyxia so that we ought not to weigh equally the chances of the child against those of the mother. Septicemia is often noted in patients particularly prone to occur in placenta previa cases and may be ascribed to the manipulation and lacerations in a woman whose resisting powers are necessarily lowered by hemorrhage. Control of the hemorrhage during the process of dilatation remains the important indication and this I believe can be more effectively made by the extra-ovular introduction of the bag than by any other means.

My attention was first called to this method by its description in the textbook published by E. B. Cragin shortly before his death. In reading this description I was struck by the good results which he claimed for the method and while at first skeptical of its value I soon afterward began to employ the method. Although not an infallible procedure I believe that a thorough trial will convince everyone of its practicability and value in the majority of cases. It is for this reason that I have ventured a preliminary report on the procedure in the expectation of publishing a more complete study at a later date. I have now become impressed with the fact that as an emergency measure it is much superior to the intra-ovular introduction of the bag because less harm is done by hospital internes or others for example than if the perforation of the placenta with a Braxton-Hicks version or intra-ovular introduction of the bag is carried out. As soon as a diagnosis is made no further manipulations are necessary in attempting to enter the amniotic cavity and the bag may be introduced through the os alone very much more quickly.

A few words of direction may be opportune at this point. The patient is quickly prepared by shaving the vulva and scrubbing or the application of iodine. She is then placed in the lithotomy position. An anesthetic is usually unnecessary. A large sized Voorhees bag folded upon itself and held by an introducer is inserted directly into the cervix and preferably introduced on that side away from the placenta. This is not essential however

and I have usually directed the distention of the bag as soon as the greater mass of the bag has entered the os. The clamp is removed and warm sterile water injected slowly so that the bag adjusts itself in the direction of least resistance which is usually under the membrane rather than the placenta. Two fingers of one hand should be kept in the vagina so as to guide the inflating bag; otherwise it may be displaced into the vagina rather than find its way into the lower uterine cavity. As soon as the distention is complete the stem is firmly tied and placed in the vagina. It is not necessary to have it project from the vulva or to attach a weight to the same. I believe that this increases the dangers of infection and laceration. It is remarkable how quickly even actively bleeding cases show a checking of the hemorrhage. Pains if not present usually begin within an hour and the labor proceeds without the loss of additional blood. A careful watch must be kept on the patient and it may be advisable to make a vaginal examination at least every two hours. As soon as the bleeding reappears an immediate examination should be made because this usually points to the expulsion of the bag. If this is not done considerable blood may be lost because the bag is no longer in place. In many instances rupture of the membranes occurs spontaneously about this time in the incomplete varieties of placenta prævia and the presenting part engages and descends. There need not be any haste manifested and the labor may be allowed to be completed normally. The further steps in delivery depend on the conditions present. Where engagement and descent are prevented a version with breech extraction may be considered but it seems safer to allow labor to proceed normally for the child is often considerably asphyxiated and undue lacerations to the maternal soft parts may result from the rapid delivery. More dangerous hemorrhages unquestionably result from deep cervical tears than from the placental site. Bleeding may occur immediately after the delivery of the child but I think it is advisable to conserve the patient as much as possible and have therefore advocated the immediate

expression of the placenta followed by the injection of 1 or 2 cubic centimeters of pituitrin or the administration of ergot by mouth if prompt uterine contraction does not result. Every placenta prævia case should be carefully watched for postpartum bleeding but in the series of cases treated by this method intra uterine picking has rarely been required. As cervical lacerations are unlikely it is not necessary as a rule to examine the cervix and intravaginal manipulation is therefore avoided. Perineal lacerations are also unlikely as in the majority of cases we are dealing with multiparae.

It is not my purpose to recount in detail here the cases in which the extra-ovular insertion of the bag has been employed but three typical instances in which the method was used are however presented.

Mrs. L. M. age 33, para near term with a history of previous normal pregnancies, labors and puerperal periods. Two weeks prior to admission to the hospital the patient bled profusely. A physician was called who gave her some medicine after which the bleeding stopped. Three days before admission the bleeding started again and her physician then packed the vagina and sent her to the Lying In Hospital on March 1910. On admission she was found to be very pale, moderately shocked. No fetal heart heard. Red blood cells showed a count of less than 3,000,000 with a hemoglobin of 35 per cent. A marginal placenta prævia was diagnosed the cervix two fingers dilated the patient having slight pains. At 10:30 a.m. a No. 4 Voorhes bag was inserted extra-ovularly which stopped the bleeding at once and induced strong uterine contractions. The bag was expelled at 1:40 p.m. followed by rupture of the membranes and the immediate engagement and descent of the head. In view of the patient's anemia, 100 cubic centimeters of citrated blood was given at 2:30 p.m. and at 3:00 p.m. an easy forceps delivery of a large dead baby was done. The placenta was readily expressed and the uterus packed with iodoform gauze. The patient made an uninterrupted recovery but continued to bleed slightly after she was up.

This case may be regarded as typical for a large amount of blood had been lost previous to delivery and any rapid method of extracting the child would undoubtedly have resulted in complete collapse of the patient. The case with which the cervix dilated and the complete stoppage of the bleeding undoubtedly was the cause of saving her life.



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 u t u l l l t n d th n e n l v  
 p t a d l s d o l th f l t e r o n  
 l n n l u n g h l l t a i e d Th t l m u t t  
 l l l l t c y r t i v e l y l i g h t n d j e r h i p  
 o e t h u n y l a v l l r

A resume of the cases of placenta previa  
 taken from the record of the New York  
 Lying In Hospital from June 1904 to  
 December 1 1918 showed a total of 54  
 Among them there are recorded 15 death of  
 mother (14 per cent) and 105 death of  
 children after delivery A total of till  
 birth r e r o r d e d making a total foetal  
 mortality of 38 or 6 percent The cases  
 were treated by a variety of methods other  
 than the extra ovular hys insertion While  
 this is rather an alarming proportion of both  
 in utero and fatal death the fact must be  
 borne in mind that a great many of these cases  
 were sent in by outside physicians after  
 various methods of treatment had been  
 employed and usually considerable haemorrhage  
 had resulted I am not prepared to  
 state at the present time how many of the  
 mothers died of sepsis and how many of  
 hemorrhage In most of the cases that were

admitted to the hospital from outside sources  
 the physician in attendance has usually  
 tamponed the vagina in an effort to stop the  
 bleeding but this procedure is rarely effec  
 tuous the tampon material being insufficient  
 and not properly placed This attempt at  
 checking the hemorrhage is unproductive of  
 results and under the environment in which  
 it is employed is a factor of great danger to  
 the patient namely septic infection It has  
 also been noted in many of these cases that a  
 history of bleeding has been present for vary  
 ing periods from a few days to a few weeks but  
 notwithstanding this warning nothing has as  
 a rule been done to discover the source of the  
 same While admitting the difficulty of  
 making a diagnosis in cases of undilated  
 cervix the fact that bleeding is present  
 should induce greater care on the part of the  
 attending physician If the patient is unable  
 to have proper care in her home she should be  
 referred to a hospital until a diagnosis can be  
 established

The personal cases previously referred to  
 are but three examples of about ten con  
 cutive case of placenta previa which I  
 have observed with the extra ovular hys  
 method Although insufficient in number  
 to permit of general conclusions they have  
 impressed me with the value of the procedure  
 and in calling attention to a method which has  
 not been very extensively used and is purely  
 obstetrical in character it is with the hope  
 that it may be given a more extensive trial  
 by other It seems particularly adapted to  
 multipart with moderately softened cervixes  
 is readily applied does not of itself cause  
 additional bleeding reduce the necessity  
 for extensive manipulations is free from  
 shock and safer and more efficient for emer  
 gency use

## A STUDY OF FROZEN SECTIONS OF THE PELVIS WITH DESCRIPTION OF AN OPERATION FOR PELVIC PROLAPSE\*

By ALFRED BAKER SPALDING M.D. SAN FRANCISCO  
F. M. D. Obst. & Gynec. Lect. at the School of Med.

THE descriptions of the fasciæ of the female pelvis as found in most standard textbooks on anatomy are frequently confusing and always unsatisfactory. They are usually printed in small type and barely cover the variations from the male pelvis which is far more clearly described. This perhaps accounts for the fact that to many operators the pelvic fasciæ seem to have only vague anatomical and physiological value and only limited if any surgical utility.

According to Halban and Tandler the pelvic fasciæ may rupture immediately behind the symphysis giving rise to a sliding cystocele or urethrocele or between the cervix and the bladder permitting cystocele with prolapse of the uterus or between the cervix and the rectum as seen in some cases of prolapse with rectocele or finally behind the rectum causing prolapse of the rectum.

A year ago Chipman in an address before this society designated these conditions as sacropubic herniæ and described a method for closing the various bernal openings. Of recent years several other good methods for the cure of pelvic hernia have been proposed. Some of these operations however serve only to cure the cystocele while permitting the prolapse of the uterus to recur while others support the uterus without curing the cystocele. A few operations seem to owe their popularity more to the ease and rapidity with which they can be carried out than to the degree of permanent relief the patient may obtain. The entire subject of pelvic prolapse is a complex one and while it is self evident that very often the lacerated overstretched atrophic meshwork of fasciæ and muscles of the pelvic diaphragms cannot be restored to anatomical completeness still it is also clear that a knowledge of the anatomy of the pelvic fasciæ and muscles is a help in operating and an understanding

of the close relation existing between the pelvic fasciæ and the many venous plexus is of aid in preventing such postoperative complications as hæmorrhage, pelvic hæmatoma, sloughing and fistula formation.

For these reasons and for the purpose of correlating the surgical values of the various pelvic fasciæ with anatomical descriptions I have made a study of the pelvis of a, year old nullipara which had been frozen and cut into four segments.<sup>1</sup>

The first section of this pelvis begins at a point 4.5 centimeters above the symphysis on the abdominal wall, passes downward and backward through the acetabula laterally to end in the coccyx just below the sacro-coccygeal joint. The plane is slightly higher on the right side. It passes above the bladder in front, severs the uterus just below the internal os and the rectum posteriorly. The distended rectum has dislocated the cervix somewhat to the right. The upper surface of the first segment has been photographed as shown in Figure 1.

A strong thick mass of vascular tissue surrounds the cervix. On either side can be seen the superior edge of the obturator internus muscle covered by the obturator fascia. The levator ani muscles do not appear at this level but a thin band of coccygeus muscle can be seen posteriorly. Overlying the obturator fascia is the pelvic fasciæ which passes under the peritoneum to the sides of the bladder to form its lateral true ligaments. On the right side of the rectum the sacro-uterine ligament is seen quite well developed.

The second section passes in a plane centimeters below the first. It severs the bladder, the external os of the cervix, the vagina and the rectum passing to a point just below the tip of the coccyx. Figure

The pelvis prepared by Dr. Alfred Baker Spalding

Read before the American Gynecological Society at the 10th Annual Meeting, June 1910



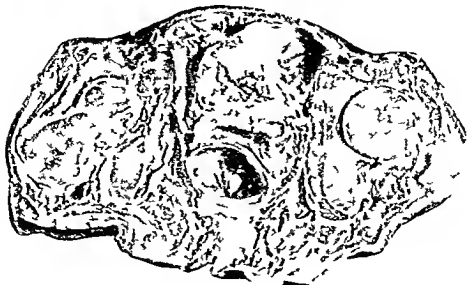


FIG. 3. Section through pelvis 3 centimeters above symphysis to point just below coccyx. Shows upper surface of segment made by second and third section. The bladder with its anterior and lateral true ligament is seen anteriorly. The vagina with the tip of the cervix is supported on either side by the fascia endopelvic which joins the pelvic fascia lining on the obturator fascia to form the arcus tendineus. Between the bladder and the vagina is a fascial layer of fascia 1 centimeter thick. Surrounding the rectum is the levator ani muscle attached on either side to the obturator fascia at the arcus tendineus musculi levatores ani.

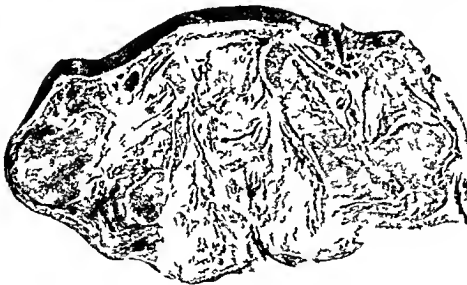


FIG. 4. Section 1 centimeter above symphysis through anal canal posteriorly. Shows lower surface of segment made by second and third sections. Anteriorly is the posterior surface of the symphysis. The horizontal attachment of the fascia endopelvic vagina and the levator ani muscles to the obturator fascia pulls the urethra, vagina and anal canal close to the lower edge of the symphysis.

called the arcus tendineus or white line. On either side is the well developed obturator internus muscle covered with its fascia. About midway posteriorly at a point which is somewhat lower than the arcus tendineus

can be seen the origin of the levator ani muscle from the obturator fascia forming a less well marked white line called the arcus tendineus musculi levatores ani. These muscle surround the rectum. Some fibers



Fig. 1. Pelvis, showing the position of the bladder, uterus, and vagina, and the position of the levator ani muscles.

passing to a point near the tip of the coccyx. Of surgical interest is the layer of vascular fascia nearly 1.5 centimeters thick which lies between the bladder and the vagina and joins the fasciæ endopelvicæ at the true white line. This fascial layer appears to be intimately interwoven into the wall of the bladder and the vagina but with care can be separated without hemorrhage from each. The overlapping of this fascia after separation from both the bladder and vagina as far as the white line gives exceedingly strong support to the bladder when herniated as in cystocele. Between the rectum and the vagina the same vascular fascial layer somewhat less in thickness than that between the bladder and the vagina can be seen as well as the thick levator ani muscles covered above and below by fascia which joins the obturator foramina at the point of origin of the levator ani muscles.

The third section of the pelvis passes 1.5 centimeters below the second section at the ventral point and 2 centimeters below at the dorsal point. On the ventral point the section begins just above the symphysis pubis passes downward and backward along the posterior surface of the symphysis to sever the urethra at the base of the bladder, the vagina and the anal canal. The fascial planes shown in Figures 1, 2 and 3 are here

seen in continuation in Figure 4 which is a photograph of the lower surface of the second segment. The urethra and the base of the bladder are strongly attached to the lower part of the symphysis and the vascular fascial wall of the vagina are attached along the anterior cornua closely to the arcus tendineus.

The fourth and most inferior section of the pelvis was made parallel to the above 2 centimeters lower and passes along the anterior surface of the symphysis to sever the urethra and vagina near the vulvar orifice. It shows in part the joining of the fascia of the vaginal walls with the deep layer of the triangular ligament.

The uterus as shown in Figure 1 is suspended at the internal os by a mass of parametrial tissue which includes the sacro-uterine and the cardinal ligaments. This tissue is intimately attached to the curved arcus tendineus of the pelvic fascia. The arcus tendineus also gives attachment to the vascular fasciæ between the vagina and bladder and the vagina and rectum which hold up and support the bladder and rectum. The levator ani muscles and fasciæ pull the lower portion of the vagina and rectum toward the symphysis as seen in Figure 3 and by their sphincteric action give potential support to the bladder, uterus and rectum.

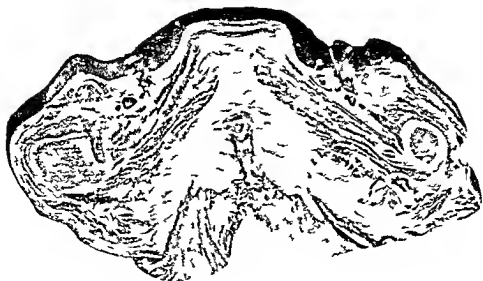


FIG. 6. Section along anterior surface of symphysis. Shows lower surface of segment made by third and fourth section. Fascia of vaginal wall joins deep layer of triangular ligament.

Above the internal os are structures not shown in these frozen sections. The broad ligaments undoubtedly aid in supporting the uterus partially by direct and partially by indirect action. In conjunction with the round ligaments they pull the fundus of the uterus forward which carries the cervix and the structures around the cervix to the hollow of the sacrum. With the uterus in this position intra-abdominal pressure helps to support the pelvic organs by leverage action.

A year ago Rawls in a paper on "Cystocele" covered the literature on the operative history for the cure of sacropubic hernia. In this list was the operation described by Watkins of interposing the uterus between the bladder and the vagina and the modification suggested by Jellett of dissecting *per agnam* the sacro-uterine ligaments and transplanting them to the anterior surface of the uterus. Some years ago these operations were utilized in the Women's Clinic at Stanford in an effort to cure marked conditions of prolapse with cystocele and rectocele. In general good results were obtained but occasionally following the dissection of the sacro-uterine ligaments postoperative hematomata would form giving a stormy convalescence which required

in some instances further operative interference for the relief of pain or for the purpose of drainage. Without the Jellett procedure several patients operated upon by the Watkins technique suffered with recurrence particularly in regard to the cervix and rectum. Resort was then made to the Goffe operation which consists in removing the uterus *per agnam*, suturing the rather crushed stumps of broad ligaments together and suspending the bladder by sutures to the round and broad ligaments.

It was our unfortunate experience to have some cases of postoperative fistula form at the site of one or other of the bladder stitches. In one instance this resulted in an ureteral fistula. At the same time we saw several patients operated upon elsewhere by vaginal hysterectomy who suffered with a recurrence of cystocele and whose ultimate cure depended upon very delicate dissection and overlapping of the pelvic fascia in the anterior vaginal wall. Despite the dangers we have followed quite a large series of patients operated upon by the procedures of Jellett or Goffe who have had no recurrence for over a period of seven years. In April 1917 J. Craig Noel<sup>1</sup> presented before the meeting of the California State Society a method of dissecting the

<sup>1</sup> Cf. M. St. J. M. J. 2.

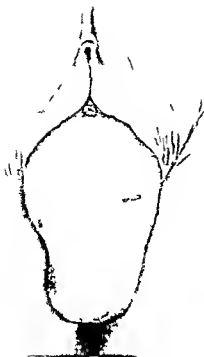


Fig 7. P. l. p. f. the t. th m k d y t l  
F m d n m d t t h t m t p a t o M l d  
t l p n t b t o t h b y r t t

fascial layer in the anterior vaginal wall and of overlapping this fascia a cording to the method presented independently a year ago to this society by Paul.

During the past two years I have utilized the procedure for the cure of cystocele with excellent results and recently have combined it with amputation of the cervix and subtotal vaginal hysterectomy for the cure of prolapse of the uterus with cystocele and rectocele. This technique is more effective and less dangerous than total hysterectomy. It preserves the invaluable paracervical fascia and ligaments and avoids the dangers of hemorrhage, sloughing and fistula formation.

The operation has been applied to all degrees of uterine prolapse with cystocele and rectocele where it was permissible to remove the uterus. It depends for success on attaching to the cervical stump the sacro uterine broad and round ligaments *per aequam* the round ligaments being drawn through the cervical canal and sutured to the raw surface of the amputated cervix



Fig 8. Th ed t ly t the bl dd  
t t th f ep t d f m the bl dd th  
t th t l p i g

before closing the vaginal flaps. The supra vaginal portion of the cervix which has attached to it the all important supporting structures at the base of the broad ligament becomes so fixed in scar tissue later that it cannot be drawn down with instruments by vaginal examination. It also forms an important supporting point for the attachment of the overlapped fascia between the vagina and bladder and for the less strong fascia between the vagina and rectum.

The various steps of the operation are carried out in the following order:

The fascia overlying the cystocele is exposed by a deep transverse incision across the cervix at the bladder junction as shown in Figure 8. If this incision be superficial the strong fascial plane will remain attached to the bladder. The vaginal wall with the fascia is separated from the bladder rather widely laterally. Before opening the per-

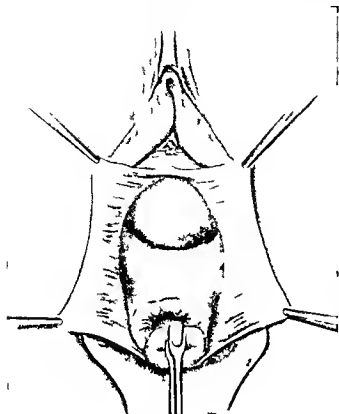


Fig 9 Before perineum, the perineum the cervix is amputated removing the mucous membrane of the cervical canal

toneum the bladder is pushed up and the vaginal portion of the cervix removed as a cone (Fig 9) according to the method of Hegar. A stitch is placed on either side of the cervix to ligate the vaginal branches of the uterine vessels and the posterior half of the cervix is covered by a vaginal flap. The next step consists in opening the peritoneum and lifting the bladder away with a broad Doyen retractor. The fundus of the uterus is delivered as in an interposition operation the round ligaments cut and tied with long catgut ligatures the broad ligaments are clamped close to the uterus as far as the internal os and the fundus of the uterus removed by amputation (Fig 10). This exposes the sacro uterine ligaments which are shortened if necessary. The stumps of the broad ligaments are sutured to the cervix (Fig 11) and the cut round ligaments carried through the cervical canal and sutured to the inferior surface of the cut cervix (Fig 12). The mucous lining of the cervix is removed previous to this procedure. This pulls the cervix high and gives some

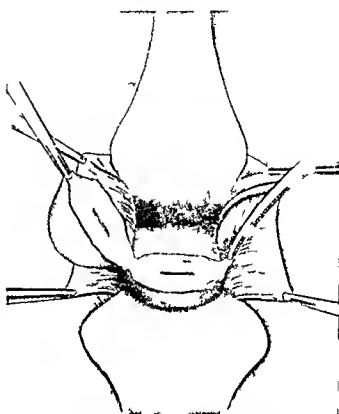


Fig 10 The bladder is elevated and abdomen packed. The fundus of the uterus delivered and amputated above the internal os. Mucous membrane of cervix removed.

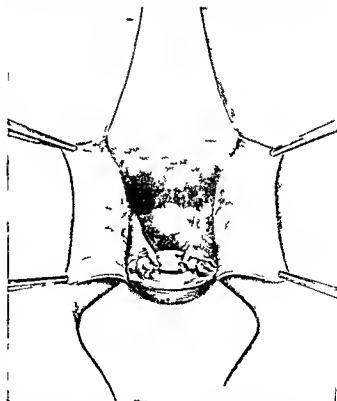


Fig 11 The stumps of the broad ligaments have been sutured to cervix. The peritoneum of bladder could be sutured at this time to the posterior surface of cervix.



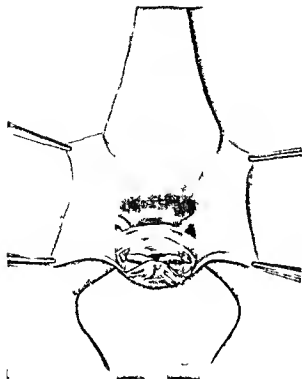


Fig. 12. The rectum is prolapsed and is being held in place by several sutures. The bladder is visible above the rectum, and the uterus is partially visible.

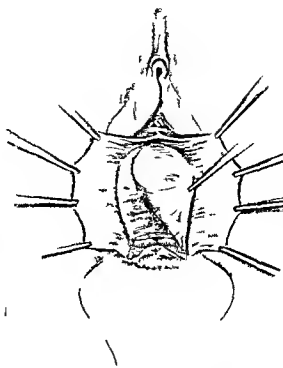


Fig. 13. The rectum is prolapsed and is being held in place by several sutures. The bladder is visible above the rectum, and the uterus is partially visible.

support to the lateral walls of the bladder when removing the retractor. The fascia in the anterior vaginal wall (Fig. 13) is now dissected and overlapped as described by Neul and Lawl and sutured to the stump of the cervix. This completely closes the bladder hernia. The muco-a is sutured by means of a few interrupted catgut sutures over the fascia and the anterior half of the cervix.

If the rectum is prolapsed the posterior vaginal wall is incised from the fourchette to near the cervix and the rectal hernia closed by suturing with a lifting stitch the prolapsed rectum to the sacro-uterine ligaments on either side. Where possible the fascia between the rectum and vagina is sutured and the vaginal flap closed. The levator ani muscles are brought together at the pelvic outlet together with their fascial covering which close the

vulva to normal. Finally the vagina is rather firmly packed for 4 hours.

So far the patients operated upon according to this technique have had no serious complications. Bleeding at the time of operation has been slight and there have been no infection or hematoma formation. Not infrequently however there has been difficulty in voiding for from 10 to 14 days. On discharge the cervix has been found high posteriorly with the bladder and rectum well supported. Sufficient time has not elapsed to express a positive opinion but from present indications the preservation of the cervix and the paracervical tissue supported by the broad and round ligaments with the overlapping of the fascial layers give promise of value for the cure of those patients suffering with prolapse and cystocele in whom the sacrifice of the uterine body is not contra-indicated.

OVARIAN RESIDUE<sup>1</sup>

By WILLIAM P. GRAVES, M.D., F.A.C.S., BOSTON

IN an article read two years ago before the Gynecological Section of the American Medical Association it was claimed by the writer that there is manufactured in the general ovarian tissue an internal secretion equal in therapeutic value to that produced in the corpus luteum. The statement was presented in the form of a preliminary report chiefly on theoretic grounds with a promise to publish clinical data as soon as sufficient material might be collected to be of scientific worth. The object of this paper is to fulfill that promise.

The presentation of any clinical report on ovarian organotherapy must be made somewhat apologetically and with due modesty as regards any claims of strict scientific accuracy for the chances of error in observation both on the part of the physician and the patient are so great that even the most carefully compiled statistics are in many instances only a little better than an expression of general impressions.

In order to avoid misleading conclusions it is always necessary to keep in mind the ways by which one is liable to fall into error. Inasmuch as the symptoms and conditions for the relief of which ovarian substance is therapeutically indicated are chiefly of a purely human character animal experimentation is for the most part excluded. In the treatment of such subjective symptoms as the vasomotor disturbances of the menopause or the ovarian asthenias or the diverse manifestations of dysmenorrhœa one must rely in the tabulation of results on the patient's statements which it must be admitted are frequently inaccurate. In treating the more objective irregularities of the menstrual flow observations are somewhat more accurate but here again the results of treatment are not subject to the inspection of the investigator and the reported records in a given case must depend on the patient's personal statement which is often vague.

Thus the clinical data appended to an

article on organotherapy like this one for example show decidedly of the patent medicine experiences detailed in the advertising columns of the daily papers and for this reason quite justly perhaps they have invited the criticism of those who are accustomed to more scientific methods of investigation.

Another serious handicap to one who is endeavoring to make a systematic test of ovarian substance is the difficulty encountered in securing reliable preparations. There are to be sure certain excellent products on the market but in prescribing them at random it is impossible to guarantee that the patient will receive an article that is even in a passable state of preservation. It seems to be little appreciated that all ovarian preparations excepting possibly those in ampule form deteriorate more or less rapidly and it has been my experience that even the best dispensing pharmacists take few precautions to preserve them in a fresh state. The great diversity in the results observed in organotherapy is undoubtedly largely due to this factor of ready decomposition of the material.

The difficulty in securing fresh material I have been able partially to avoid by the kindness of two wholesale drug manufacturers who have furnished me with preparations so that it has been possible to dispense them free to patients. In this way not only was freshness of the product insured but a greater regularity of treatment was attained than would have been possible by prescribing such high priced drugs as the ovarian extracts have come to be.

The term ovarian residue relates to that part of the ovary which remains after ablation of the corpus luteum and has usually been discarded as valueless. I was led to make use of it as a therapeutic agent in the course of trying out various ovarian preparations. In my earliest experiments with ovarian therapy I had employed exclusively corpus luteum extracts in accordance with the

belief then generally prevalent that the active part of the internal secretion of the ovary is produced solely by the luteal cells. The results of the treatment were irregular and unsatisfactory though an occasional case responded successfully. In the light of later experience there seems to be no doubt that the ill success of these earlier trials was due in part at least to ignorance of the rapid deterioration of luteal products. It is not to be wondered at that Dr Burnam who was able to secure abundant fresh corpus luteum material attained far more brilliant and constant results than was possible for those who were dependent for their supply on the unreliable stocks of dispensing druggists.

My next experiments were with a dried preparation of the whole ovary put up in capsule form by a local drug firm. It was possible in this way to secure a uniform product in a reasonable state of preservation. Favorable results immediately appeared and with such constancy that the prescribing of ovarian extracts became an important feature in my gynecological practice. The superiority of the whole ovary preparation over those of corpus luteum I at first ascribed theoretically as did others to a separate internal secretion elaborated in some part of the general ovarian stroma. Undoubtedly however the great improvement in the result was in a measure dependent on the greater uniformity and freshness of the material which I was able to control. It is also probably true that preparation of the whole ovary retain their therapeutic value somewhat longer than do those of the corpus luteum alone.

I next treated with desiccated corpus luteum from pregnant cows a series of about 60 cases having menopause symptoms. The treatment of these cases was almost universally unsuccessful due chiefly to the production of active digestive disturbances which in a few instances were severe and protracted. Others notably Burnam have employed the corpus luteum of pregnancy with success though it is admitted by all that digestive disturbances are sometimes encountered. The failure in my own series of cases can be explained by the probability that the two particular lots of capsules which

were sent under presumably favorable conditions had become decomposed and that the patients had been treated to a mild form of proteid poisoning. It further supports the statement that corpus luteum preparations rapidly decompose though this deterioration is to a certain extent delayed by the tablet form in which they are at the present day usually dispensed.

The ill success of the experience with the corpus luteum alone as compared with the excellent results from the whole ovary naturally led to a trial of the ovarian residue. As I have stated at length in other articles the uterovarian residue as a therapeutic agent is not without a logical basis. There is good evidence that in the process of growth at least the theca luteal cells of the atretic follicles are important agents in the manufacture of the ovarian internal secretion. The theca luteal cell which become activated in the physiological process of follicle atresia correspond to the segregated cells of the interstitial gland found in certain animals and generally accepted as a source of internal secretion. Moreover the theca luteal cells of follicle atresia are known to be analogous to the cells of Leydig which elaborate the active secretory principle in the testicle. If it be accepted that the luteal cells of the corpus luteum are entirely or even in part proliferated from the connective tissue cells of the theca interna it is reasonable to conclude that an internal secretion is elaborated both by the atretic follicles and the corpora lutea which is identical in that it has the same histological source in both bodies. This theory would be confirmed if it could be shown that preparation of the ovarian residue produce clinical results identical with or similar to those produced by preparations of corpus luteum and this confirmation seems to have been established by the results appended to this paper.<sup>1</sup>

By the kindness of Dr Grant ovarian residue material was acquired and dispensed free to patient careful notes were taken and observations made as accurately as possible with the limitations mentioned above.

The immediate impression received by the writer in noting the results of administering

ovarian residue was that though similar in action to the corpus luteum and whole ovary and applicable to the same kinds of cases its effects were somewhat more definite and more constantly reliable than those from either of the other two

Though not proved by experimentation *in vivo* it has seemed evident that the residue retains its chemical integrity longer than the other preparations and indeed it is entirely possible that its superiority in therapeutic value may be due to its greater resistance to decomposition

In employing ovarian residue an endeavor has been made to secure as far as possible the ovaries of pregnant animals on the ground that follicle atresia is more active during pregnancy

The number of cases reported is less than could be desired. This is due to the fact that on account of the exigencies of the war the material furnished by one of the drug firms could no longer be obtained so that the work was long interrupted. I wish to express my indebtedness to Hynson Westcott & Dunning who have recently interested themselves in the work and who are now supplying me with abundant material

In addition to the possible errors in a clinical report of this kind it should be mentioned that there is in the ovarian residue a minute amount of corpus luteum substance due to the fact that the corpora lutea are ablated by machinery and that small fragments are sometimes left behind. The amount of luteal tissue is however so insignificant that it could have but little effect on the results of treatment

The present report as it stands is incomplete without a full comparison with the results from other ovarian preparations. This work is being done and will serve as a basis for a later paper

It may be said here that I have a series of cases treated with whole ovary which nearly parallels those of the ovarian residue. The statistical results in these two series are so nearly alike that it is impossible to draw any absolute conclusions. However the general impression received in using the two forms of ovarian therapy is in favor of the residue. A

shorter series of cases treated with corpus luteum reveals a comparatively higher percentage of failures than in the use of the other two forms

It is at present justifiable to conclude—

1 That the ovarian secretion is not solely confined to the corpus luteum a view which some still hold

That the secretion of the atretic follicles and the corpus luteum is a similar product being manufactured by analogous cells namely by those proliferated from the internal theca

2 That the ovarian residue preserves its chemical integrity longer than do those ovarian preparations which contain corpus luteum substance

3 That under present conditions of preparation ovarian residue is in general superior in its clinical results to the commercial articles now on the market

The brief case reports appended to this article are divided into three groups first those exhibiting the symptoms of the natural and artificial menopause second those treated for such menstrual disturbances as amenorrhœa oligomenorrhœa delayed menses and clotting third those of essential dysmenorrhœa

The majority of the cases of the first group were treated for postoperative hot flushes. In only a few of the cases were the symptoms severe and in many they were not a source of complaint being elicited only after questioning the patient. Ovarian residue was administered therefore in many instances chiefly for the purpose of testing its effects on these characteristic vasomotor manifestations. For hot flushes ovarian residue like the other ovarian preparations acts as a specific palliative rarely failing to give some relief. For those multiple neurosecretory symptoms such as dizziness sleeplessness headaches muscular pains buzzing in the ears asthenia etc. which are so common in the natural though not in the artificial menopause ovarian residue is helpful in many cases

In the first group there are in all 41 cases and there is good evidence that the treatment exerted a definite beneficial action in 30 or in 78 per cent

In the second group of amenorrhœas etc

there were failures especially in the long standing cases of amenorrhœa. In some instances of delayed menses and clotting the results were rather striking. Even in the amenorrhœa cases in which the menstrual rhythm could not be reestablished the patient often mentioned the general tonic effect of the treatment. This was especially true where other pluri-glandular disturbances were evident. The stimulating effect of the ovarian residue could sometime be enhanced by the addition of thyroid and the anterior lobe extracts.

The third group of essential dysmenorrhea is quite incomplete due to the fact that I have only recently used the residue in the treatment of this important disorder. Most of the case here appeared represent patients who have not been relieved of their menstrual symptoms by surgical measures. It will be seen that even in the case the ovarian residue exhibits a distinct therapeutic value. I am now treating a considerable number of dysmenorrheic cases of the acute inflexion type with the hope of avoiding operative interference but sufficient time has not yet elapsed to warrant definite conclusions.

#### NATURAL AND ARTIFICIAL MENSTRUATION

CASE 1. M. F. W. Ovarian residue (P. D.) for hot flushes after hysterectomy for fibroid and polypus. Result: Report favorable. No further treatment.

CASE 2. M. S. L. K. Ovarian residue (P. D.) for hot flushes following hysterectomy for fibroid and polypus. Result: Report favorable. No further treatment.

CASE 3. M. A. V. Ovarian residue (P. D.) for natural menses. Report by letter: (re-appeared) Report favorable. No further treatment.

CASE 4. M. S. M. B. Hot flushes following hysterectomy for fibroid and polypus. Result: Report favorable. No further treatment.

CASE 5. M. S. C. Ovarian residue (P. D.) for hot flushes following hysterectomy for cancer. Result: Report favorable. No further treatment.

CASE 6. Miss S. G. T. Ovarian residue (P. D.) for hot flushes following hysterectomy for fibroid. Report by letter: Report favorable.

CASE 7. Mrs. K. W. C. Ovarian residue (P. D.) for hot flushes following hysterectomy for pelvic inflammation. Result: Report favorable.

CASE 8. M. S. C. P. Ovarian residue (P. D.) for hot flushes following hysterectomy for multiple

fibroids. Result: Report favorable. Very much improved.

CASE 9. Mr. J. D. D. Ovarian residue (P. D.) for pelvic inflammation. Report: Report favorable. No further treatment.

CASE 10. Mrs. C. C. D. Ovarian residue (P. D.) for hot flushes following hysterectomy for chronic pelvic inflammation. Report: Report favorable.

CASE 11. M. S. M. D. Ovarian residue (P. D.) for natural menses. Report: Report favorable.

CASE 12. M. I. D. I. Tentative treatment for hot flushes following hysterectomy. No result. Report: Report favorable.

CASE 13. Mrs. E. N. H. Ovarian residue (P. D.) for hot flushes following hysterectomy for pelvic inflammation. Result: Report favorable.

CASE 14. Mr. I. H. Ovarian residue (P. D.) for hot flushes following hysterectomy for large fibroid. Result: Report favorable.

CASE 15. M. S. A. H. Ovarian residue (P. D.) for hot flushes following hysterectomy for multiple fibroids. Result: Report favorable.

CASE 16. M. F. H. Ovarian residue (P. D.) for hot flushes following hysterectomy for large fibroid. Result: Report favorable.

CASE 17. M. J. Ovarian residue (P. D.) for hot flushes following hysterectomy for cancer. Result: Report favorable.

CASE 18. M. O. J. Ovarian residue (P. D.) for hot flushes following hysterectomy for uterine fibroid. Result: Report favorable.

CASE 19. M. S. L. K. Ovarian residue (P. D.) for hot flushes following hysterectomy for large fibroid. Result: Report favorable.

CASE 20. M. H. K. Ovarian residue (P. D.) for hot flushes following hysterectomy for large fibroid. Result: Report favorable.

CASE 21. Mr. G. W. K. Ovarian residue (P. D.) for hot flushes following hysterectomy for large fibroid. Result: Report favorable.

CASE 22. M. S. B. L. Natural menopause. Result: Report favorable.

CASE 23. M. S. B. L. Natural menopause. Result: Report favorable.

CASE 24. M. P. H. M. Ovarian residue (P. D.) for hot flushes following hysterectomy for chronic pelvic inflammation. Result: Report favorable.

CASE 25. M. S. E. M. Ovarian residue (P. D.) for hot flushes following hysterectomy for large fibroid. Result: Report favorable.

CASE 26. M. S. J. M. Ovarian residue (P. D.) for hot flushes following hysterectomy for large fibroid. Result: Report favorable.

rebel Hot flushes returned after discontinuing treatment

CASE 28 Miss M P Hot flushes following hysterectomy for chronic pelvic inflammation very neurotic No relief from ovarian extract (Armour) ovarian residue (P D) followed by marked improvement for 3 months Return of hot flushes not relieved by ovarian residue (I D) either capsules or hypodermically

CASE 29 Mrs T P Ovarian residue (P D) for hot flushes following supravaginal hysterectomy No effect

CASE 30 Mrs W H W Ovarian residue (P D) for natural menopause symptoms No results

CASE 31 Mrs W L W Ovarian residue (P D) for molimina following hysterectomy with implantation No results

CASE 3 Mrs M T S Ovarian residue (P D) for natural menopause symptoms No special effect

CASE 33 Mrs S Operation in 1910 for uterine fibroid both ovaries left *in situ* Cancerous cyst developed in both ovaries Operation 1916 Removal of cancerous cysts Operation followed by hot flushes which were immediately and completely relieved by ovarian residue (P D) The patient died of recurrent cancer

CASE 34 Mrs I S Ovarian residue (P D) for hot flushes following hysterectomy for chronic pelvic inflammation Complete relief

CASE 35 Miss B S Corpus luteum (H W & D) for hot flushes following hysterectomy for large ovarian cysts No effect from corpus luteum or ovarian residue

CASE 36 Miss A S Ovarian residue (I D) for hot flushes following hysterectomy for large adherent fibroid Greatly improved Flushes return when treatment is discontinued

CASE 37 Mrs W H R Hot flushes following hysterectomy for fibroid Ovarian extract (Armour) no relief Mixed Gland No (B & W) and ovarian residue (H W & D) Complete temporary relief

CASE 38 Mrs G W R Ovarian residue (H W & D) for natural menopause complete relief

CASE 30 Miss M P Ovarian residue (H W & D) for hot flushes following hysterectomy for large adherent twisted pedicle cyst of ovary and multiple fibroids Improved

CASE 40 Mrs F T I Ovarian residue (H W & D) for menopause symptoms following radium Almost complete relief

CASE 41 Mrs M C Ovarian extract (H W & D) for hot flushes following hysterectomy for chronic pelvic inflammation Immediate improvement

#### AMENORRHOEA DELAYED AND SCANTY MENSES

CASE 1 Mrs G A K age 33 Ovarian residue (I D) for amenorrhoea following lactation No results

CASE 2 Miss G M age 4 Normal uterus Functional amenorrhoea No results from corpus luteum Ovarian residue (P D) and (H W & D) followed by rather slight menstrual flow

CASE 3 Mrs M P M age 21 Scanty menses and sterility Undeveloped uterus Ovarian residue corpus luteum and ovarian extract given combined with electricity Three unsuccessful attempts at artificial impregnation Gradual improvement in catamenia and increase in size of uterus followed by natural impregnation and normal delivery Effect of ovarian treatment problematic in this case

CASE 4 Miss D O Ovarian residue (H W & D) for functional amenorrhoea Pain in lower back and lower abdomen continued sleeplessness No effect on amenorrhoea at first Greatly improved constitutional symptoms Marked tonic effect Ovarian residue (H W & D) alternated with corpus luteum (H W & D) produced same effect Slight menstrual flow after five months treatment Later report Feels fine while taking medicine Last report Has had normal period

CASE 5 Mrs R R R age 32 Uterus undeveloped long continued amenorrhoea No effect from ovarian residue combined with electricity Hetero transplantation in the cervix followed by one normal period Continued treatment with ovarian residue (P D) no effect

CASE 6 Miss F S age 19 Ovarian residue (P D) Delayed menses with general feeling of discomfort Immediate and continued improvement

CASE 7 Mrs N S age 20 Uterus undeveloped second degree retroversion Ovarian residue (P D) for continued amenorrhoea combined with thyroid extract Marked constitutional improvement no relief of amenorrhoea

CASE 8 Miss A W age 23 Ovarian residue (P D) for amenorrhoea following radium treatment for long continued menorrhagia Corpus luteum ovarian residue and ovarian extract given for many months when catamenia was re-established The effect of ovarian treatment in this case is problematic

CASE 9 Miss E W age 22 Uterus normal Complete functional amenorrhoea Two months treatment of ovarian residue (P D) followed by normal period which was the first catamenial flow that the patient ever had Continued treatment

CASE 10 Mrs A F W age 6 Functional amenorrhoea Ovarian residue (I D) followed by normal period One report

CASE 11 Mrs F C N age 30 Functional amenorrhoea No effect from ovarian residue (P D) corpus luteum (H W & D) followed by normal period No later report

CASE 12 Miss G M M age 28 Functional amenorrhoea dullness apathy Ovarian residue (I D) combined with thyroid extract Greatly improved in general condition Disappearance of dullness no relief of amenorrhoea

CASE 13 Miss H C I age 1 Functional amenorrhoea Ovarian residue (I D) followed by normal flow one report

CASE 14 Miss C E P age 36 Amenorrhoea following curettage for menorrhagia. After several months treatment with ovarian residue (H W & D) normal period re-established. Seven months later curettage. During this time patient had no flushes which were relieved by the ovarian residue treatment. Effect of ovarian residue on amenorrhoea in this case probably curative.

CASE 15 Miss M W age 32 Delayed and scanty menses adiposities dullness apathy Ovarian residue (H W & D) Catamenia at the end of nine weeks. The greatest improvement in general health relief from apathy. Treatment continued. Site noted with corpus luteum (H W & D). Nine months after first treatment the patient reports that she is having regular normal periods. In six good health.

CASE 16 Miss M M age 35 Also epistaxis under dysmenorrhoea. Long continued treatment with extract of whole ovary and ovarian residue (P D) re-established menstrual rhythm. At the end of four years patient states that she is dependent on no treatment for regularity of menses.

CASE 17 Miss R P age 30 Irradiation negative Ovarian residue (H W & D) for delayed menses. Report: Period came on after taking pills for 27 days and was normal in every way.

CASE 18 Mrs K P age 40 Ovarian residue (P D) for scanty menses. Increased to normal.

CASE 19 Miss C D age 6 (th) anovulation (P D) given for scanty catamenia following removal for menorrhagia. Normal periods re-established.

CASE 20 Miss A N age 25 Ovarian residue (P D) for functional amenorrhoea. No results. Periods established after the use of Methyl Gland. No B & W.

CASE 21 Miss M O J age 31 Ovarian residue (H W & D) for scanty menstruation. Treatment re-established normal periods. Credited to some indication from capsule due probably to lack of feshiness.

CASE 22 Mrs C M Y age 30 Delayed and scanty catamenia. After taking ovarian residue (H W & D) the patient menstruated for the first time in four years. Excellent result. All effects.

CASE 23 Mrs S I W age 40 Ovarian residue (H W & D) for delayed catamenia. Nausea and weakness at catamenia. The patient's position markedly improved in all symptoms.

CASE 24 Miss A S age 3 Ovarian residue (H W & D) for prolonged interrupted menses. Normal menses re-established.

#### DYSMENORRHOEA

CASE 1 Miss B B age 26 Operation for retroversion did not relieve symptoms. Neurotic Ovarian residue (P D) for dysmenorrhoea. Report: Did not help me. Of course I only used one bottle and feel that perhaps I did not give them a fair trial.

CASE 2 Miss M N age 19 Not relieved by operation for retroversion. Ovarian residue (H W & D) Report: Greatly benefited. Health

them. Symptoms returned as bad as ever when tablet given out.

CASE 3 Mrs W I B age 2 No relief from operation for anteversion with retroversion. Ovarian residue (H W & D) Report: Very beneficial. Last report states that dysmenorrhoea is greatly relieved when taking ovarian residue before period. Dysmenorrhoea recurs when medicine is omitted.

CASE 4 Miss M B age 19 Uterus normal. Small gitter. Ovarian residue (P D) for dysmenorrhoea and clotting. Report by telephone: Both conditions improved.

CASE 5 Miss H C age 23 Pelvic examination negative. Ovarian residue (P D) for dysmenorrhoea and headache. Complete relief at first effect of treatment. Lenses marked in last report.

CASE 6 Miss R A D age 3 Uterus normal. Ovarian residue (P D) for dysmenorrhoea and clotting. Immediate improvement of both symptoms. Last report: Illa never in my life had such easy menstrual periods. Clots much less than before treatment.

CASE 7 Mrs A J E age 31 Slight retroversion and prolapse. Ovarian residue (H W & D) for dysmenorrhoea. Scanty menstruation with headaches. One report: Some improvement.

CASE 8 Miss O E age 3 Retroversion on floor. Dysmenorrhoea not relieved by operation. Ovarian residue (H W & D) One report: Only took the pills two days before I started to flow. Pain was less on first day. This is my hardest day.

CASE 9 Mrs I F age 30 Anteversion. Dysmenorrhoea and sterility. Corpus luteum (H W & D) gave no relief. Treatment changed to ovarian residue (P D). Report from letter: Almost complete relief from dysmenorrhoea. Scanty.

CASE 10 Miss L F age 15 Anteversion. Small uterus. Multiple Ovarian residue (P D). First report: There has been a gain but the periods are apt to vary. Later report: Pain at period gradually growing less.

CASE 11 Miss M D age 27 Uterus normal. Dysmenorrhoea not relieved by dilatation. Ovarian residue (H W & D) for dysmenorrhoea. Report by letter: Pain less since taking pills.

CASE 12 Miss S W G age 33 Chronic pelvic inflammation. Small intramural fibroid. Marked neurotic Ovarian residue (P D) for dysmenorrhoea. Not improved. Late hysterectomy.

CASE 13 Miss M G age 3 Anteversion. Ovarian residue (P D) for dysmenorrhoea and scanty catamenia. Immediate improvement of dysmenorrhoea. Later increase of flow. Tablets acted like a tonic. Numerous satisfactory reports.

CASE 14 Miss R C age 3 Slight anteversion. Slight improvement with extract of the whole ovary. Changed to ovarian residue (P D). Marked improvement. Report by letter: Pain greatly improved by last medicine.

CASE 15 Miss F B H age 35 Long narrow cervix. Ovarian residue (P D) for scanty painful catamenia. Report by letter: Slight improvement.

CASE 16 Miss L H age 44 Myomectomy did not relieve dysmenorrhœa Ovarian residue (H W & D) Marked improvement

CASE 17 Miss M M age 18 Undeveloped uterus Catamenia regulated by ovarian extract Dysmenorrhœa also relieved Change to ovarian residue produced same satisfactory effect Omission of ovarian treatment caused recurrence of symptoms Treatment continued over period of four years This is a good case to prove the physiological effect of ovarian therapy

CASE 18 Miss A M W age 7 Operation for retroversion did not relieve dysmenorrhœa Ovarian residue (P D) Report I am sure it helped me because menstruation has been much less painful than usual

CASE 19 Miss B S Pelvic examination negative Ovarian residue (H W & D) for dysmenorrhœa Immediate relief Treatment discontinued symptoms recurred Treatment continued using both (P D) and (H W & D) preparations Relief of nausea and dysmenorrhœa

CASE 20 Miss C G P age 21 Ante flexion and retrocession Ovarian residue (H W & D) Only one report No relief

CASE 21 Miss A P age 41 Normal uterus Ovarian residue (P D) for irregular and difficult catamenia Many favorable reports Last report Repeated magical effect

CASE 2 Miss I F age 23 Previous operation multiple myomectomy Ovarian residue (P D) for premenstrual pain no relief

CASE 23 Mrs A C age 35 Normal uterus Ovarian residue (P D) for menstrual headache general depression One report A brilliant improvement

CASE 4 Mrs H P age 31 Operation for retroversion relieved intermenstrual pain only temporarily Ovarian extract given for recurrence of pain Temporary relief Ovarian residue (P D) given greater relief than from ovarian extract

CASE 25 Mrs E W C age 35 Dysmenorrhœa headache and clotting Ovarian residue (P D) and (H W & D) Treatment continued over considerable period with marked increasing improvement

CASE 26 Mrs I P age 24 Dysmenorrhœa and delayed menses Treatment followed by normal period without pain One report

CASE 7 Mrs C F M age 38 Premenstrual discomfort scanty catamenia with sleeplessness hot flushes nervousness All the symptoms were greatly improved by ovarian extract (P D)

CASE 28 Miss L D Headaches at catamenia Report Wonderful result from pills

CASE 29 Ovarian residue Mrs H H R Dysmenorrhœa and nervous symptoms Used ovarian residue (P D) for two years with general benefit



# AGE DISTRIBUTION AND AGE INCIDENCE IN 500 CASES OF CANCER OF THE UTERUS<sup>1</sup>

R. BELF PETTERSON, M.D., F.A.C.S., AND ARBO MITCHELL

**I**NTEREST in the age incidence of carcinoma of the uterus was aroused by a recent case of this disease observed in the Gynecologic Clinic of the University Hospital.

A young married woman, age 36, was admitted to the Hospital November 10, 1908, with a complaint of abnormal menstruation and pain. During the previous 6 months the periods had become more frequent and increased in amount and she was greatly distressed by a full abdominal change. For 3 months prior to her admission to the hospital she had had great pain in the pelvis and back and had lost considerable weight.

Vaginal examination revealed a foul, bloody, fetid discharge and a large, firm, nodular mass in the lower part of the uterus, extending into the vagina. The mass was lobulated and the surface was covered by a thick, white, cheesy material. The mass was removed by the abdominal route and the patient recovered.

With a view of determining the age incidence of cancer of the uterus in a large series of cases, material was collected from the following sources:

1. Cases of uterine cancer from 1901 to 1918, Gynecologic Clinic, University of Michigan Hospital. 98
2. Cases of uterine cancer 1902 to 1918, Private Clinic. 55
3. Cases of uterine cancer from other sources 1893 to 1918, Pathological Laboratory, University of Michigan. 147

Total 500

The cases were not selected but were included in the list as they occurred chronologically up to 500 cases, a number large enough to allow of accurate conclusions being drawn.

Each of the 500 cases of uterine carcinoma had had the diagnosis confirmed microscopically in the University of Michigan Pathological Laboratory by its director, an acknowledged authority, whose final judgment can not be questioned.

Many other cases admitted to the University and private clinics during these years were undoubtedly uterine cancer, the diagnosis being so easily made by palpation and the appearance of the growth that no tissue was sent to the pathologist for confirmatory diagnosis. In many cases where macroscopic diagnosis was considered unnecessary, the subsequent death of the patient was recorded in the notes, leaving absolutely no doubt as to the correctness of the clinical diagnosis. However so abundant was the material that it was thought best not to include such cases in the list to be analyzed.

The investigation may be considered supplementary to the admirable work along the same line which has been conducted by Doctors A. S. Warthin and Carl V. Weller of the Department of Pathology for whose generous aid and co-operation I am greatly indebted.

It seems necessary to state again here what has been emphasized by these two authors regarding the material at the Pathological Laboratory, namely, that it is almost entirely derived from the State of Michigan and represents the average population of the State since the University Hospital are not charity hospitals in the sense that they are filled with non-paying pauper patients. In the same way the 55 private cases and the 147 cases from other sources may be said to represent the same average population.

For the purpose of this paper at least the words distribution and incidence as applied to the ages of the cancer cases will be used in a different sense. Age distribution will refer to the number of cases in the series of 500 which is found at each age period while age incidence will refer to the ratios at any given age period obtained by considering the percentage of carcinoma at that age period in reference to the percentage of the population at the same period.

Age distribution and age incidence in the 500 cases have been considered under the following headings chosen for either anatomical or microscopical reasons

- 1 Carcinoma of the uterus
- 2 Carcinoma of the cervix
- 3 Carcinoma of the fundus
- 4 Squamous cell carcinoma of the cervix
- 5 Adenocarcinoma of the cervix

In all tables and charts the ages have been divided into five year periods the first multiple of five being inclusive. For example the age period 40 to 45 includes all cancer cases whose ages are 40 41 42 43 44. Cases of age 45 however are placed in the succeeding period.

This arrangement of the age periods in multiples of five was deliberately chosen in order to make it easier for the average person to retain the figures in mind a somewhat hopeless task where another arrangement is chosen.

The United States Census report of 1900 was chosen in preference to the 1910 report in figuring the percentage of total female population living at the different age periods for the reason that the figures for the five age periods above the age of 65 were not given in the most recent report. However as explained by Doctor Weller in his article the possible error is negligible since the variations in age distribution over a few years are very slight.

# 1 AGE DISTRIBUTION IN CARCINOMA OF THE UTERUS

Table I shows the age distribution of the 500 cases of uterine cancer.

The age distribution of these cases is also well shown graphically in Chart 1. Starting with 7 cases between the ages 20 to 25 the curve rises rapidly until it reaches its maximum at the age period 40 to 45. This agrees with our former ideas regarding the age when cancer is most to be feared at about the menopause. The line then sharply falls only to rise again at the 50 to 55 age period. A slight lowering at the age period 55 to 60 is followed by a rapid decline up to the age 85.

It must be borne in mind that this chart represents the age distribution of both cer-

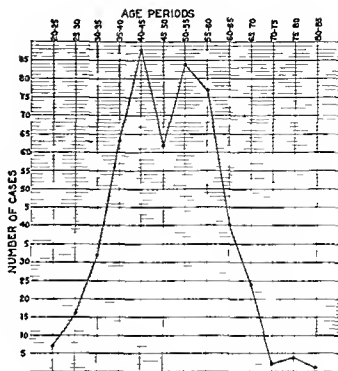


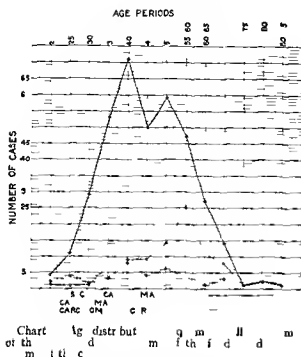
Chart 1 Age distribution in 500 cases of carcinoma of the uterus

vical and fundal carcinoma and must be studied in connection with Chart 2 to explain why the curve remains so high until the period 55 to 60. As will be brought out later the series contains a rather large proportion of fundal carcinoma cases (94) the maximum age period of which is between 55 and 60. This keeps the curve up in Chart 1 until the sudden drop at the age period from 60 to 65.

A study of Table I shows that 82 per cent of uterine carcinoma occurs between the ages of 35 and 65. This corresponds very nearly to the figures of Wilson whose analysis

TABLE I—AGE DISTRIBUTION IN CARCINOMA OF THE UTERUS

| Ages     | N   | mb | f | C | P | Log  |
|----------|-----|----|---|---|---|------|
| 20 to 25 | 7   |    |   |   |   | 1.4  |
| 25 to 30 | 16  |    |   |   |   | 3.2  |
| 30 to 35 | 3   |    |   |   |   | 6.4  |
| 35 to 40 | 63  |    |   |   |   | 12.6 |
| 40 to 45 | 85  |    |   |   |   | 17.6 |
| 45 to 50 | 6   |    |   |   |   | 12.4 |
| 50 to 55 | 84  |    |   |   |   | 16.8 |
| 55 to 60 | 7   |    |   |   |   | 15.4 |
| 60 to 65 | 40  |    |   |   |   | 8.0  |
| 65 to 70 | 4   |    |   |   |   | 5.2  |
| 70 to 75 | 4   |    |   |   |   | 0.4  |
| 75 to 80 | 4   |    |   |   |   | 0.8  |
| 80 to 85 | 1   |    |   |   |   | 0.2  |
|          | 500 |    |   |   |   |      |

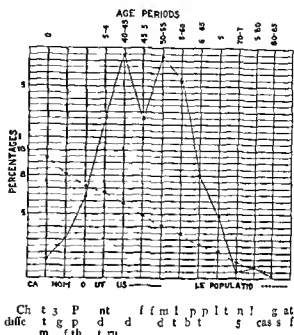


of the ages of 403 patients with uterine cancer shows 86 per cent between the ages mentioned.

Naturally a distinction is made between carcinoma of the cervix and fundus since it has been well established that adenocarcinoma of the fundus appears at a later age period than does carcinoma of the cervix. Hence the findings of other writers will be deferred until carcinoma of the fundus is considered.

Out of 500 cases there were 7 cases of carcinoma between the ages of 0 and 25. Of these 4 were squamous cell of the cervix 2 adenocarcinoma of the cervix and 1 adenocarcinoma of the fundus. If 14 per cent of carcinoma of the uterus occurs in young women between the ages mentioned our ideas regarding the immunity of the young female for carcinoma must be radically changed.

Gavraud found but 3 cases of cancer of the uterus in the first twenty years of life. It is questionable if these cases (Eckhardt, Ganghofer, Tchopp) are not in reality teratomas or sarcoma and not carcinoma. Adams case of carcinoma in a child two and one half year old was so reported upon by the pa-



Ch t s P nt f f m l p p l t n l g at  
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thology committee of the Royal Society of Medicine.

Cragin's case of squamous cell carcinoma in a single woman of 18 and Wells' case of adenocarcinoma at the level of the internal os in a young married woman of 18 would seem to be genuine cases. The same may be said of de Rouville's case of squamous cell carcinoma in a young unmarried girl of 18.

Webster quotes Gussacrow's statistics showing two cases of uterine carcinoma in women below the age of 20 in 3,471 cases. Hoffmeier in 860 cases did not have a single case of uterine carcinoma under 20 years of age. Koblanck's statistics in Veit's *Handbuch der Gynaekologie* show that there were only two cases of uterine carcinoma in women under 20 in 6334 cases of carcinoma of the uterus.

From this evidence it may be concluded that uterine carcinoma below the age of 20 is exceedingly rare that it is infrequent but that it does occur in an appreciable percentage of cases between 20 and 55.

The age of the youngest patient in the series of 500 cases of uterine carcinoma was 21 while the age of the oldest was 82. The average age for the entire series was 47.5 years. Tindley reports a case of cauliflower

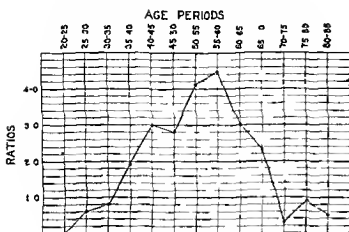


Chart 4 Age incidence in carcinoma of the uterus

cancer unconfirmed by microscopical examination in an old lady of 93

### AGE DISTRIBUTION IN CARCINOMA OF THE CERVIX

It has been found convenient to divide carcinoma of the uterus into two classes as it affects the cervix or fundus since the natural history of the disease in the two locations shows marked differences

TABLE II—AGE DISTRIBUTION IN CARCINOMA OF THE CERVIX

| Age      | Number | Percentage |
|----------|--------|------------|
| 0 to 25  | 6      | 1.4        |
| 25 to 30 | 15     | 3.6        |
| 30 to 35 | 31     | 7.6        |
| 35 to 40 | 56     | 13.7       |
| 40 to 45 | 79     | 19.4       |
| 45 to 50 | 53     | 13.0       |
| 50 to 55 | 65     | 16.0       |
| 55 to 60 | 52     | 12.8       |
| 60 to 65 | 29     | 7.1        |
| 65 to 70 | 16     | 3.4        |
| 70 to 75 | 1      | .2         |
| 75 to 80 | 2      | .4         |
| 80 to 85 | 1      | .2         |
| Total    |        | 406        |

In this table will be found cases of both squamous cell and adenocarcinoma of the cervix. It will be noted that the cervix was the seat of this disease in 6 out of the 7 cases occurring between the ages 0 to 25 and the fundus was affected in only one case at these ages.

The youngest patient in the 406 cases where the cervix was affected by carcinoma was 21 and the oldest 80—the same as in the preceding group.

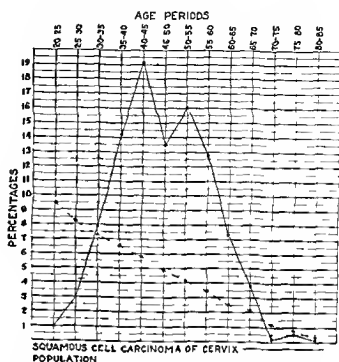


Chart 5 Percentage of the female population living at different age period and squamous cell carcinoma of the cervix.

The maximum number of cases in this group will be found between the ages of 40 and 45 as would be expected since the greater proportion of the 406 cases of cervical cancer are of the squamous cell type.

The average age of the 406 cases of cervical cancer was lower by two years than in the complete group of 500 cases being 45.5 as compared with 47.5.

### AGE DISTRIBUTION IN CARCINOMA OF THE FUNDUS

In the 500 cases of uterine carcinoma the fundus was the seat of the disease in an unusually large percentage of cases 94 out of 500 or 18.8 per cent. This may possibly be explained by the fact that every suspicious case in both the public and private clinics is subjected to a diagnostic curettage and that all curettings undergo routine examination in the Pathological Laboratory. In this way not only are many suspicious or borderline cases proved microscopically to be carcinoma but a considerable number of unsuspected cases is returned with diagnosis of adenocarcinoma of the fundus.

A study of Table III and Chart shows that the distribution of carcinoma where the

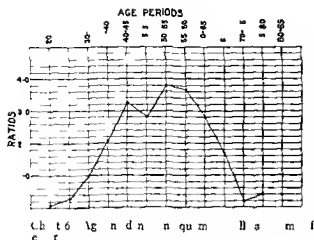
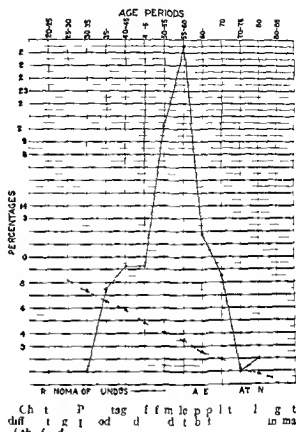


TABLE III — AGE DISTRIBUTION IN CARCINOMA OF THE FUNDUS

| Age   | Number | Percent |
|-------|--------|---------|
| 25-30 | 0      | 0       |
| 30-35 | 0      | 0       |
| 35-40 | 4      | 4       |
| 40-45 | 0      | 0       |
| 45-50 | 9      | 9       |
| 50-55 | 9      | 9       |
| 55-60 | 5      | 5       |
| 60-65 | 8      | 8       |
| 65-70 | 0      | 0       |

94



shows the greatest age distribution in cancer of the cervix between ages 40 and 45 while the maximum distribution in carcinoma of the fundus is ten years later or between 50 and 59.

In the 15 years preceding age 35 there were only 3 cases of carcinoma of the fundus showing that in this location it is not a disease of early life. This observation is borne out by other statistics. Young and Williams found 3 cases out of 17 of fundal carcinoma under 40 years of age. Anderson and Platt out of 33 cases of carcinoma of the fundus found none under 40 years of age. Wilson in 56 cases of fundal carcinoma in his series found none under 45.

As previously stated there were 94 cases of adenocarcinoma of the fundus in the 500 cases or 18.8 per cent. Anderson and Platt found carcinoma of the fundus in about 15 per cent of their 253 cases of uterine carcinoma. The percentage is very low in Koblanck's statistics being only 4.4 per cent.

fundus alone is involved reaches its maximum at the age period 55 to 60, 15 years later than in squamous cell carcinoma of the cervix which as already stated, at the age period 40 to 45. Wilson in his series of cases found it 5 years subsequent to the maximum distribution of squamous cell carcinoma (45 to 55). Levin in an analysis of 613 cases of cancer of the uterus collected from the foremost New York hospital found the distribution of cervical cancer greatest during the age period 45 to 60, the same being the case with carcinoma of the body. However during these periods cervical cancer was only 49 per cent while fundal carcinoma was 55 per cent. These statistics are open to the objection which can be raised against many of this nature that the diagnoses apparently have not been checked up by careful microscopical examination. Koblanck's analysis of 6354 cases of uterine cancer

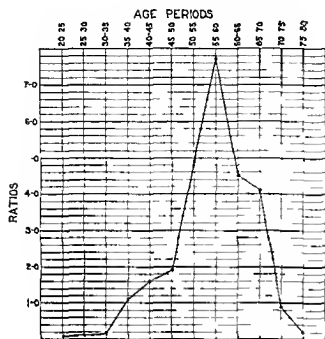


Chart 8 Age incidence in carcinoma of the fundus

in 6354 cases Kutner's (Wisselink) percentage was 9.4 Hofmeier (Steinbach) 11.1 Hammer 13 Olshausen (Wilkins) 1 and Wilson 11. From this it is fair to assume that in a given series of cases of uterine cancer from 10 to 15 per cent will prove to be located in the fundus.

In the 94 cases the youngest patient was aged 27 and the oldest 75.

The average age of the 94 cases of adenocarcinoma of the fundus was 54.1 years exceeding by nearly 10 years the average age of the 406 cases of cervical cancer (45.5).

#### 4 AGE DISTRIBUTION IN SQUAMOUS CELL CARCINOMA OF CERVIX

As would be expected since it has long been recognized that this form of uterine cancer is most frequently met with the cases of squamous cell carcinoma of the cervix formed the largest group in the series there being 369 cases in all.

Table IV should be studied in connection with Chart 9 where the distribution of the cases of squamous cell carcinoma of the cervix is shown graphically. In Chart 2 it will be noted that the curve rises much more abruptly than with the two other varieties of carcinoma adenocarcinoma of the fundus and cervix and reaches its maximum at the

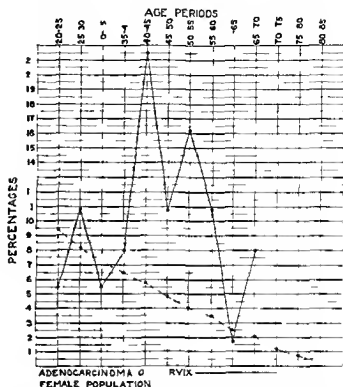


Chart 9 Percentage of female population and adenocarcinoma of the cervix

TABLE IV — AGE DISTRIBUTION IN SQUAMOUS CELL CARCINOMA OF CERVIX

| Age      | No. of cases | Percentage |
|----------|--------------|------------|
| 0 to 25  | 4            | 1.08       |
| 25 to 30 | 22           | 2.9        |
| 30 to 35 | 29           | 7.8        |
| 35 to 40 | 53           | 14.3       |
| 40 to 45 | 71           | 19.2       |
| 45 to 50 | 50           | 13.5       |
| 50 to 55 | 50           | 13.5       |
| 55 to 60 | 47           | 12.7       |
| 60 to 65 | 7            | 1.9        |
| 65 to 70 | 14           | 3.8        |
| 70 to 75 | 1            | 0.27       |
| 75 to 80 | 2            | 0.54       |
| 80 to 85 | 1            | 0.27       |
| Total    | 369          |            |

age period 40 to 45 with 71 cases. After a slight rise at age period 50 to 55 the descent is quite rapid.

In contradistinction to carcinoma of the fundus (Table III) there is quite a proportion of cases in early life 97 or 23.5 per cent being under the age of 40. Again 180 or practically 50 per cent of the 369 cases occur from 40 to 55 the ages during which the menopause is most frequently met with.

The youngest patient with squamous cell carcinoma in this series was 21 the oldest 82.

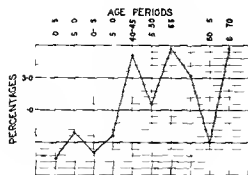


Chart 1. Age and incidence of the fundus.

The average age of the 369 cases was 46.6 years, one year older than where the two varieties of cervical carcinoma are considered together and 9 years less than the average for carcinoma of the fundus.

#### 5. AGE DISTRIBUTION IN ADENOCARCINOMA OF THE CERVIX

This variety of uterine cancer is much more rare than either squamous cell carcinoma of the cervix or adenocarcinoma of the fundus. For this reason the graphic curve is subject to greater fluctuation (Chart 1) and the age distribution in a larger series of cases than 37 might give different results.

TABLE 1. — AGE DISTRIBUTION IN ADENOCARCINOMA OF CERVIX

| Age   | Number | Percentage |
|-------|--------|------------|
| 0-5   | 4      | 5.4        |
| 5-10  | 4      | 5.4        |
| 10-15 | 3      | 4          |
| 15-20 | 4      | 5.4        |
| 20-25 | 4      | 5.4        |
| 25-30 | 6      | 8          |
| 30-35 | 4      | 6          |
| 35-40 | 4      | 8          |
| 40-45 | 3      | 8          |
| 45-50 | 3      | 8          |
| 50-55 | 3      | 8          |
| 55-60 | 3      | 8          |
| 60-65 | 3      | 8          |
| 65-70 | 3      | 8          |
| 70-75 | 3      | 8          |

The greatest number of cases of adenocarcinoma of the cervix is at the age period 40 to 45 which correspond to the findings in carcinoma of the uterus and squamous cell carcinoma of the cervix (Chart 1).

Other facts to be noted in this table are that this variety of cancer unlike the same variety in the fundus is found fairly frequently in the early years of life. Between 20 and 40

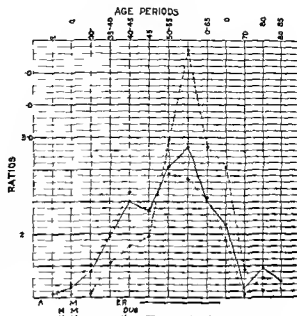


Chart 2. Age and incidence of the fundus.

years of age there were 11 cases of adenocarcinoma of the cervix or 30 per cent of the 37 cases, a greater percentage than was found for squamous cell carcinoma of the cervix for the same period.

Again the cases in this group are more evenly divided after 40 years of age up to 70 than in the other varieties of cancer. There were no cases after the age of 70 which again differs from the squamous cell variety of cervical cancer and from adenocarcinoma of the fundus. The youngest patient was 23 years of age the oldest 67. The average age of the 37 cases was 44.7 years below the average for carcinoma of the uterus as a whole, squamous cell carcinoma of the cervix and carcinoma of the fundus.

Up to this point the 500 cases have been studied in reference to different age periods. It now becomes necessary to study them in connection with the total living female population at given period if correct interpretations are to be made regarding the age incidence of the series as a whole and its different varieties. With this end in view a series of charts has been made so that the carcinoma incidence in the various groups may be graphically shown.

First the percentage of the total female population during each age period and the percentage of the 500 carcinoma cases for each age period is graphically shown followed by a second graphic chart in which the carcinoma incidence at the different age periods is arrived at by dividing the percentage of carcinoma for different age periods by the percentage of the population at the same age periods. This last as shown by Doctor Weller in his article may be represented as follows

Ratio for age period

$$N = \frac{\text{percentage of carcinoma cases in age period}}{\text{percentage of female population in age period}}$$

**Carcinoma of uterus** A study of Chart 3 (percentage of female population and of carcinoma of uterus) and Chart 4 (age incidence in carcinoma of uterus) is very interesting. In Chart 3 the carcinoma curve lies below the population curve up to the age of 35. The carcinoma curve then rises rapidly and reaches its highest point at the age period 40 to 45. After some variations between age periods 40 to 45 and 55 to 60 the curve descends rapidly to cross the population line again between the age periods 65 to 70 and 70 to 75.

The true carcinoma incidence at different ages arrived at by the series of ratios as previously described is shown in Chart 4. Here the apex of the curve is seen to be at the age period 55 to 60 which represents the greatest carcinoma incidence. After this point is reached the curve descends rapidly to age period 70 to 75, rising slightly at the next two five year periods.

**Squamous cell carcinoma of the cervix** In Chart 5 the carcinoma curve crosses the population curve before the age period 30 to 35 and reaches the maximum at age period 40 to 45. However by the ratio computation the greatest carcinoma incidence is shown to be 10 years later or at age period 50 to 55. After this the curve rapidly falls up to the age period 70 to 75.

**Adenocarcinoma of fundus** In Chart 7 the carcinoma curve crosses the population curve at nearly the 35 to 40 age period the apex of the curve being at age period 55 to 60. This corresponds to what may be called the

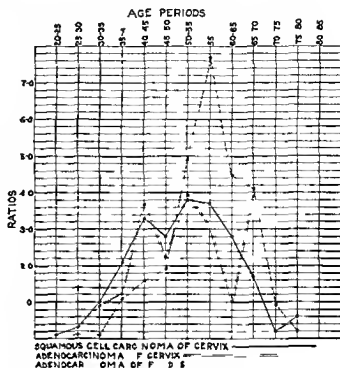


Chart 12 Age incidence in squamous cell and adenocarcinoma of the cervix and adenocarcinoma of the fundus

true carcinoma incidence which is greatest at the same age period as shown in Chart 8. Again in this chart is shown the sudden drop in the age incidence after the apex of the curve has been reached.

**Adenocarcinoma of cervix** As pointed out previously the variations in the carcinoma curve as shown in Chart 9 are probably due to the small number of cases for the carcinoma and population curves cross and recross which did not happen with the other charts when a greater number of cases was considered. However the two charts of this variety of cancer are reproduced to show this fact and to show also that the carcinoma incidence is greatest at age period 50 to 55 which corresponds to the maximum carcinoma incidence in squamous cell carcinoma of the cervix.

**Age incidence in carcinoma of uterus fundus and cervix** The age incidence of carcinoma of the uterus as a whole and carcinoma situated in the fundus and cervix is shown graphically in Chart 11.

In carcinoma of the uterus taken as a whole and adenocarcinoma of the fundus the greatest carcinoma incidence is at age period 55 to 60 whereas in carcinoma of the



cervix it is at age period 50 to 55 equaling what was found for these two varieties in other parts

The age incidence in the three varieties of uterine cancer is shown in Chart 12

For the sake of convenience and ready reference the age periods of greatest carcinoma incidence in the different divisions of the subject have been arranged in Table VI

TABLE VI—AGE PERIODS OF GREATEST CARCINOMA INCIDENCE

|                                   |          |
|-----------------------------------|----------|
| Carcinoma of cervix               | 50 to 55 |
| Squamous cell carcinoma of cervix | 50 to 55 |
| Adenocarcinoma of cervix          | 50 to 55 |
| Uterine carcinoma                 | 55 to 60 |
| Adenocarcinoma of fundus          | 55 to 60 |

#### SUMMARY

1 The maximum age distribution in 500 cases of cancer of the uterus is at the age period 40 to 45

2 Between the ages 55 and 65 occurs 8 per cent of uterine cancer

3 The young female is not immune to cancer since 7 of 500 cases or 1.4 per cent occurred between the ages of 20 and 35

4 Uterine carcinoma below the age of 40 is exceedingly rare but it does occur in an appreciable percentage of cases between 20 and 35

5 The cervix was the seat of the disease in 6 out of 7 cases occurring between the ages of 40 and 55

6 The maximum number of cases of carcinoma of the cervix is to be found in age period 40 to 45

7 In the present series of cases carcinoma of the fundus was found in an unusually large percentage of cases 94 out of 500 or 18.8 per cent

8 The maximum number of cases of adenocarcinoma of the fundus is to be found between 55 and 60 fifteen years later than in squamous cell carcinoma of the cervix which is 40 to 45

9 Adenocarcinoma of the fundus is not a disease of early life there being in the present series only 3 cases out of 94 below the age of 35

10 From the analysis of this series and from the statistics of other writers it is fair to assume that from 10 to 15 per cent of uterine carcinoma is located in the fundus

11 A large proportion of the 500 cases of uterine cancer was squamous cell carcinoma of the cervix 369 in all

12 In contradistinction to carcinoma of the fundus 3.5 per cent of squamous cell carcinoma of the cervix is found in patients under 40

13 Practically 50 per cent of the 369 cases of squamous cell carcinoma of the cervix occurred between the ages of 40 and 55

14 Adenocarcinoma of the cervix is much more rare than the two other forms 37 out of 500 cases

15 The maximum number of cases occurs in age period 40 to 45

16 Between 20 and 40 years of age there were 30 per cent of the 37 cases of adenocarcinoma of the cervix

17 The age incidence of carcinoma of the uterus at different age period is determined by the following

Ratio for age period

$$N = \frac{c}{g} \times \frac{t}{100} \times \frac{m}{1} \times \frac{p}{g} \times \frac{d}{N}$$

18 The maximum age incidence for carcinoma of the uterus is at age period 55 to 60 it declines rapidly from this age period to the period 70 to 75

19 The greatest age incidence for adenocarcinoma of the fundus is the same as that of cancer of the uterus is a whole age period 55 to 60

20 The highest carcinoma incidence in carcinoma located in the cervix in squamous cell carcinoma of the cervix and in adenocarcinoma of the cervix is at the age period 50 to 55

21 After each age period of greatest carcinoma incidence is reached there is a sharp decrease in incidence demonstrating the correctness of the statement that the age incidence of carcinoma increases with the age period

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ELECTIVE CÆSAREAN SECTION <sup>1</sup>

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THE indications for cæsarean section have been so greatly enlarged and the profession has now had so extensive an experience with this operation that it may be well to attempt to define in a special group of cases the indications for this procedure.

Elective cæsarean section without labor at the time and under circumstances most advantageous for patient and operator is an attractive field. For the patient it avoids the suffering and delay of parturition, the disturbance of rest and the uncertainty which is often so trying for the operator; it gives him the most favorable time and circumstances for the performance of the operation.

In one class of cases there may be no reasonable doubt as to the indication for elective cæsarean section. These are patients who have had several difficult labors terminated by the death of the children occurring at various intervals of gestation and under varying circumstances. In each case spontaneous labor has been attempted with failure and a difficult and for the fœtus fatal delivery through the vagina. Spontaneous labor in these patients has occurred at varying intervals so that the question of prolonged pregnancy has not always arisen. Undoubtedly some of the pregnancies have terminated prematurely.

Under these circumstances the operator has the choice of three procedures. First, the placing of the mother upon restricted diet with careful hygiene with the hope that the fœtus may become proportionate to the shape and size of the birth canal and that successful spontaneous labor may result.

The second procedure would consist in the induction of labor at such a time as might seem most advantageous but as previous spontaneous labors had occurred unsuccessfully at various periods of gestation this would indicate the uncertainty of inducing labor.

The third choice lies in promoting the

nutrition of mother and child in the highest degree throughout pregnancy and at its termination with or without the first signs of labor performing elective section.

The advantages for this procedure are the vigorous condition of the child, an uninjured and unwearied mother and the relief from uncertainty and delay which difficult and unsuccessful labor entail.

If husband and wife elect sterilization under these circumstances shall the operator accede to their wish? This is a question difficult to answer but we must concede to them the right to request such a procedure. On the other hand if they have no living child they must be urged to avoid sterilization until several children have been obtained by repeated section or some other successful method.

The phrase physiological incompetence for labor has been employed in discussing the indications for cæsarean section. We must believe that every condition in the human body has a definite physical cause and that while macroscopically we may not be able to appreciate the condition of the tissues which produces a given result yet microscopically physiological incompetence for labor is the result of certain definite conditions existing in the tissues. These cases are usually seen in ill developed, badly nourished and neurotic primipare, some of whom are considerably beyond the usual age of primiparous women. In many of these cases the shape, size and contour of the pelvis are normal and the pelvis may even be larger than the average. Some of these patients give a history of irregular or painful menstruation, some are overweight and show symptoms of derangement in the function of the gland of internal secretion.

The most characteristic phenomenon in these cases after we take into account the evidences of malnutrition which develop during pregnancy is the failure of the uterus to cause the child to descend and engage

in the last weeks of gestation Uterine contractions are so slight as to be unrecognizable. There is no effort to bring about the fitting of the fetus into the birth canal and there is not a sign of the development of labor. In many of these patients a pathological condition of the uterine muscle or nervous supply is present. While there may be nothing in the condition which can be recognized by ordinary examination the actual inspection of the severed uterine muscle may show a condition of fibrosis which is at the bottom of the difficulty. These patients have no definite fibroid tumor of the uterus but the uterine muscle is studded with small fibrous tumors whose presence prevents the efficient contraction of the uterus and thus renders impossible the development of normal labor.

For these patients the induction of labor would be of little if any service. The deficient uterus would not act properly under external interference nor could drugs alter the efficiency of the diseased muscle. Artificial delivery becomes inevitable and if the interests of the child are to be considered elective section is the operation of choice. May I illustrate this class of cases by an example?

A primipara about 40 inherited a condition of nervous and muscular inability. She passed through her pregnancy without incident the fetus being extraordinarily well nourished. In spite of the constant attention of a skillful nurse she passed into a condition of apathy at the end of pregnancy which made it difficult to care for her. She was made to take regular exercise and her physical nutrition was good. The fetus was in breech presentation and as the time for labor came and went it was evident that artificial delivery must be practiced. The pelvis was of average size and symmetrical. The child was unusually large and the mother failed utterly to produce the phenomena characteristic of prelabor conditions. Under these circumstances a consultation resulted in the choice of elective section. A vigorous male child was successfully delivered mother and child making uninterrupted recovery. No macroscopic reason for the delay in the development of labor was found.

An unusually well developed primipara aged 34 passed through a similar experience. Under the care of a skillful nurse she took regular and abundant exercise followed strict hygienic precautions but no sign of descent or of labor developed. At elective section the uterine muscle was found studded with

small fibroids none of which fortunately was directly in the line of the incision. The first operation was so successful that in the second pregnancy the patient requested section. At this operation the condition of the uterine muscle closely resembled that first seen and but slight improvement had taken place. The second like the first operation was successful. There has been no subsequent pregnancy.

In some cases of repeated unsuccessful labor or where the mother has a number of living children and yet is in ill health during the greater part of the time with some uterine condition both parents may elect delivery by section followed by sterilization the operation to be done in such a manner as to cure the uterine condition. In many cases it is best to retain the function of the ovaries and hence the operation consists of elective delivery by section followed by the removal of the body of the uterus and fallopian tubes and the appendix. In one patient so treated menstruation has continued regularly and without pain from the uterine stump the vaginal discharge being typical and normal.

The choice of elective section in primipare is sometimes difficult. This is especially true in cases of slightly contracted pelvis and in cases where the fetus is unusually large the position and presentation abnormal and where there is reason to fear that the physiological development of the uterus is deficient. This may be illustrated as follows.

A young primipara with pelvis symmetrical and of average size was married to a well developed athletic man. The head of the fetus was at the pelvic brim the back of the child toward the right. The later period of gestation passed without the development of descent or engagement. About two weeks followed with no essential change excepting that the head of the child turned transversely across the pelvic brim when a parietal bone presented. The parents of the patient stated that she had always been a vigorous healthy girl. Her general development was average.

Under these circumstances the induction of labor would have produced uterine contractions but would not have altered the unfavorable position of the child whose descent and engagement were impossible in its vicious position. Induction of labor followed by version and extraction would have exposed the child to very considerable risk. To wait longer would have been irrational for the head of the child would become harder and time would not alter its vicious position. Furthermore the fact that labor

h l not be el ped rai ed the susp cion that some unusual c nd ti n f th uterine muscle might be p e nt f complic te matters the husband of the pat nt an officer in the Army as absent in France A consultat n a call d ith the p re t an th fr ball e re ult of the induction of l bor n ing a l l ct t on f st proffered Electi c cct on as sel ct l At ope t n the uter e mu cl v e tr r lu ily th med nd ill developed A la k male child a eadly deli r l but some d th lly e pe enc d in caus n th th n mus ul ll of th uteru to cont act propo ly U d r k u packing an l st m lation th s ompl hed M th r al ch ld m d un t r u p t e d r o v r

In primiparae in whom labor does not develop the pelvis being of average size some abnormality connected with the foetus must be suspected Here one must be careful to detect the presence of a hydrocephalic or monster child If such be present embryotomy would be indicated but in the absence of such evidence disproportion or some abnormality connected with the child may be the cause of delay

In a large ell d c l ed primipara the ere slight eff t t de nt a d eng k ment it the atur l end f gc t t n Labor failed to de l p and afte ome time electi cct n a pr u d When the uterus as j n d n unusual l ng umbilical cord w so oiled about the child that it desce t and engagem t ould o ly h l een possible b the s par tion of the pl ce ta or the rupture of th cord The e e en abnormal sou ds ov r the ut us a d it s had to say ho th con d t n could have been d agnost cted l efor the ute u as opened

It is evident that the obstetrician takes great responsibility in advising elective caesarean section It is the practice of the writer in all cases where the lives of mother and child are not plainly endangered carefully to

avoid urging operation upon any patient The results of various procedures for mother and child obtained in his own experience and also in large numbers of cases reported by others are stated to those responsible for the patient's care They must elect and the most that the physician can do is to give them fact offering his own choice and opinion only if such are requested

In the performance of elective section care must be taken to secure efficient drainage of the lochia This of course is unnecessary where the body of the uterus is removed but even then it is well to see that the cervical canal is sufficiently open to give exit to such fluid as may accumulate in the upper portion of the stump Where hysterectomy is not done some operators content themselves with passing one or two fingers from above downward through the cervix when the uterus is emptied Others pass a large sized solid dilator while some dilate the cervix with the finger pack the body of the uterus with iodoform gauze and bring the end of the gauze through the cervix into the vagina In the experience of the writer this is the safest and most efficient procedure The presence of the gauze acts as a stimulus to uterine contraction The cervix dilates sufficiently to give free exit to retained material and the removal of the gauze forty eight to sixty hours after the operation has so far not been painful or dangerous

Recovery from elective section is often more speedy and complete than after a fatiguing and tedious labor Morbidity is no greater than after any other operation of equal importance

# THE RELATION OF PREVENTIVE MEDICINE TO GYNECOLOGY<sup>1</sup>

BY HENRY P. NEWMAN, A.M., M.D., F.A.C.S., SAN DIEGO, CALIFORNIA

THE history of the progress of medical science is a record of battles against an enemy persistent as life itself. The struggle has not been to make maternal life everlasting by eliminating death but by striking ceaselessly against those errors of life which are the basis of disease make living always more worth while. The common notion that the science of medicine like the vulture gloats and battens on the miseries of the body is a sorry delusion. There should be better popular understanding of the activities of that science which has from the beginning held out strong and skillful hands to weakened humanity guiding and supporting its blind and sometimes foolish steps seeking for highest reward only the hope that some day its charge will be able to walk alone.

This then is the province of preventive medicine—to teach mankind to do without medical aid except for such conditions as do not fall within the realm of preventable diseases. Unfortunately we are still far from this achievement when we take up the problem of gynecic disease. A percentage that can scarcely be reckoned is here due to entirely preventable causes and the aim of this specialty in this post war period when our great national and racial preoccupation is reconstruction should be the identification and elimination of the cause of disease in women.

We may go at it with great thoroughness dragging it back into the remote recesses of psychology and biology or we may face it quite simply from the human standpoint asking two questions. Why are women suffering these unnecessary afflictions? and What shall we do to prevent them?

The case records of the gynecologist answer the first question but here the answer comes too late. While developmental defects faulty obstetrics infections are all causative factors the time for the correction of these evils is past.

The answer to the second question the remedy is the concern of the entire medical

profession today and when it is faced with thoroughness of purpose there will be established that relation of preventive medicine to gynecology which is not only the concern of this specialty but of the entire people. Already the new current of democracy is turning in this direction and against the tide of unconditioned medical freedom so strongly urged by the advocates of various profitable cults and isms.

No enlarging on this theme could make clearer to you the menace of such freedom for the future but colleagues the future is with us. Bolshevism in medicine will defeat itself as surely as this age will see its failure in politics. An ungoverned life is a life lost and carries other lives with it. The future is our concern and the secret of success is co operation in preventive methods.

The present brilliant showing of the effort toward hospital standardization is significant of the widespread acceptance of this fact. Not union by coalition is advocated nor by absorption of the lines of cleavage between the specialties but union in separateness and along the lines of a new relation.

The success of the old time family doctor was not of course due to his vast knowledge of all sorts of diseases but to his practical sense of the relations between morbid processes and his ability through supervision over his families to apply prophylactic measures in time. Out of his zeal to compass the orbit of knowledge and skill has grown this division of our art into the specialties thus providing ample opportunity for development of the inexhaustible mines of information. To keep this division from degenerating into what it was never meant to be the creation of unrelated arts and to insist upon return to the original basis one indivisible science of medicine should be the object of all medical societies in this reconstruction period.

Therefore the gynecologist working in the new medium of standardization can come before his colleagues of the related

specialties and make emphasis on those points in which he feels their co-operation is vital to his work. His own researches furnished by the statistics of hospitals permit him to show to what degree the lesions he handles are due to causes outside his domain in practice while well within his province of theory. For the most part he knows that he has to deal with the results of errors and neglect in the developmental and in the parturient periods and with infections. He must therefore ask of internists, family physicians and of pediatricians intensive efforts toward the control and safeguarding of the growing girl. Each time that an infantile uterus with its train of subsequent evils presents itself in an overworked school teacher, artist, student or barren wife he must make to those other specialties a plea for the more thorough supervision of girlhood and a campaign of effort toward elimination of the evil in our social and educational system which intensively cultivate the mind while destroying the body.

And when I say "destroying the body" it is unfortunately not in a spirit of sensationalism. It is a reference in cold blood to the already widely circulated reports of some of our leading authorities in obstetrical science who agree that the new type of woman appearing as the effect of overcivilization is no longer fit for maternity. Indoor life and nerve tension having prevented normal functional development they announce that it is now better that the delicate nervous woman be delivered by cesarean section than be subjected to the ordeal of labor.

Have we as gynecological specialists charged primarily not with the disease but with the health of women, no reckoning to pay in this crisis? What have we been about while the female of the species has been coming to this tragic pass? The answer is plain: developing the art of cesarean section to such an admirable simplicity that it is easier for all concerned than the trying ordeal of labor!

Gentlemen, the ordeal of labor existed before gynecology was known. No medical procedure is worthy to exist which has not

for its object the sustaining and fortifying of natural functions as well as mending the results of unpreventable accidents. We must realize how much of the object of our first efforts has already been achieved and stop short of suggesting the substitution in routine practice of artificial for natural methods.

It is now that we as practitioners of an organized specialty must turn from the laboratory and clinic for the moment in our investigations of disease and join forces with all other medical organizations and lay movements in the study and promotion of preventive measures. Instead of making our supreme effort the giving to the delicate nervous incapable mother a child by the easiest surgical method let us take up the work of giving the children yet to be born their first right: the staunch and stalwart mother to whom her normal labor shall be an expected and a remembered blessing.

Again each time that the gynecologist is confronted with the deplorable results of incompetent obstetrics he must turn to the obstetrician and offer co-operation in the battle against the blind and slipshod methods which permit all licensed and many unlicensed practitioners to practice this delicate and complicated and most important of all specialties. As I have recently pointed out in a discussion of the proportion of infant mortality and maternal morbidity due to improper obstetrics, it is not the obstetrical specialty which is to be blamed in this unfortunate state of things for obstetrical work is not done by specialists to any major extent but it is *they* who must carry the main burden of responsibility in all movements looking for amelioration of this intolerable situation. It is for them to demand that no one shall be permitted to do obstetrics who cannot show qualifications which measure up to standardized requirements; no one whose work is not open to scrutiny on hospital records; no one who is not more than willing to submit to all regulations undertaken for the sake of the patients committed to his care and of the public upon which he subsists.

Equally when the unmeasurable results of infections of a preventable sort confront the gynecological practitioner must he look

to allied specialties for promotion of effort for the elimination of such infections and contagions as are responsible for the vast havoc to the tissues under his treatment.

Veneral diseases have been black listed and barred by great campaigns undertaken in the interests of army efficiency and national pride to an extent unpredictable in pre war periods and we have been shown that all such movements can be launched and well executed once the public mind has been moved in the right direction. But it has been only by means of the knowledge gained by the hard labor and devoted researches of the medical profession that these reforms have been possible. The public mind is not yet capable of instituting right measures for the control of disease processes without the guidance of the profession. But its immense agreement with medical suggestions in this hour of need and its hearty co operation with professional effort indicate what may be expected in any concerted effort for the benefit of public health conditions.

The gynecologist who comes in contact with so many forms of easily preventable diseases should increase his efforts to enlist the help of all other specialists to the end that such manifestations of morbid processes as come within this classification shall be lessened to a minimum by prevention.

Prophylaxis is not a new word but we have had world illuminations on many old definitions and nowhere more clearly than on this word. The reconstruction of a world half ruined is proceeding along lines of prevention. There are no doctrines so emphasized today as the doctrines of prevention. The text of the day is preparedness that we shall never again be so nearly destroyed by our own weak carelessness. It is the moment for pushing all methods of preventive medicine and it is the business of each separate specialty to develop that too much neglected privilege of co operation with its supporting neighbor.

My topic is the relation of gynecology to preventive medicine. I should only weaken its application if I attempted to show in what details certain diseases of women could be eliminated by preventive measures. These

details are perfectly well known to those who listen neither is it any new knowledge I bring but as all propositions that are essentially true undergo development and take on force with the changes of the years this interdependence of specialties has assumed vast importance since it is being brought to book by the advocates of preventive medicine both professional and lay. It only needs the tremendous emphasis that can be put upon it by united effort to bring it to the forefront of medical consideration and my purpose in this paper will have been fulfilled if it goes as a message to those other groups who like this are considering today the problems of health in a race that never felt its need so deeply.

As gynecologists we can offer the most comprehensive program dealing with the health of women and immediate and full co operation with other specialties on our part will result in as widespread and momentous effects as those we have already alluded to as following the campaign against venereal diseases in our army. And the need is bringing this emphasis not as an indictment of the past but as a legitimate outgrowth of all past efforts.

Just at the beginning of the war period a glance over special society programs showed the dawning recognition of this vital demand for co operation in preventive medicine. I have before me one significant paper read to a gathering of gynecologists and its text is the absorption of these specialists in the details and practical aspects of their work to the exclusion of the theoretical part which concerns itself with research into etiology. I maintain that there is much to be said for the defense in this case. American medicine is a self made thing. It has lacked endowed institutions it has been obliged to deny emoluments to the devotee of pure research it has been built up by the average man of big ambition to excel and a very real purpose to perform thoroughly his responsible duty of making the sick well. It has been practically essential that he apply himself to the thing to be done and the way to do it.

It must not be forgotten that underlying



the enthusiasm with which the American practitioner has developed the specialties has been thus very urge toward wider knowledge. He has felt that associations of colleagues devoted to the development of one line of work offer the best substitute for the endowed institution and it has been all he could afford. It would be difficult to prove that this method has not had distinct advantages in favor of public health which is after all the *sine qua non* of the art of healing. For we have now as a result of all this intensive special application the demand for practical knowledge of laboratory theories of disease prevention a return as it were of the demand for the general medicine man who was a sort of resume of all the specialties.

The answer to this demand is not to be done the lines that were suggested before the war period i. e. wider knowledge of all the branches by each specialist. The volume of necessary knowledge has loomed too large

for any such solution to be practical. The answer must be found in this union of all the specialties into a co operation for the development of preventive medicine.

As I have said it is beyond the scope of this paper to point out the degree in which gynecology is interrelated to obstetrics to pediatrics to the department of the alienist and the internist its whole intent is to leave with you a deeper sense of the high position to which this specialty may attain when it has realized its full opportunities for co operative effort and a heartier zeal to keep in touch both in private practice and in public work with the great impetus toward preventive medicine.

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THE ETIOLOGY OF TUBAL PREGNANCY<sup>1</sup>

B. G. BROWN MILLER, M.D., F.A.C.S., WASH., D.C.

THE etiology of tubal pregnancy has been much discussed and we are all familiar with the causes usually given. I wish to present for your consideration a factor in the production of the condition which I have never seen mentioned in any of the textbooks or the papers which I have read upon the subject.

I have had about a dozen or more cases with a history about as follows. A woman misses her period and not wishing to go through pregnancy begins after a few days to take drugs to bring on menstruation or to produce an abortion. It may be she introduces catheters or other bodies into the uterus. After an interval of a few weeks she exhibits the signs and symptoms of a tubal pregnancy. Operation shows this to be the true condition.

The number of such cases which I have had has been so great and the histories

so typical that I have been forced to the conclusion that there is a causal relation between the taking of oxytocics and perhaps the other measures commonly employed in the production of an early abortion and tubal pregnancy.

I have no definite or experimental data to confirm such a conclusion but the arguments in its favor can be stated briefly as follows:

1. Impregnation can occur just before a menstrual period.

2. The length of time between the fertilization of the ovum and its implantation in the uterine cavity is generally given as between 7 to 9 days but it may be longer.

3. Anything which interferes with the passage of the ovum along the fallopian tube is recognized as a cause of tubal pregnancy. Tumors in the uterine wall torsions of the tube chronic salpingitis etc. are some of the causes of tubal pregnancy.

R. d. b. f. r. e. t. h. Am. Gy. ec. J.

1 Soc. y. Abt. C. y. J.

Ergot and similar drugs produce contractions of the uterine muscle and perhaps of the tube. The introduction of foreign bodies into the uterine cavity likewise produces such contractions. These contractions of the uterus must interfere with the passage of the fertilized ovum down the tube and thus they would tend to the production of a tubal pregnancy.

Thus it seems to be entirely possible to produce a tubal pregnancy in the attempts to bring on an early abortion.

That such is actually the case seems to be shown by the considerable number of cases which have come under my care the histories of which would show the cause of tubal pregnancy to be some attempt to bring on an early abortion.

## TOXIC EFFECTS OF FIBROID TUMORS OF THE UTERUS<sup>1</sup>

By R. R. HUGGINS, M.D., F.A.C.S., PITTSBURGH, PENNSYLVANIA

A REVIEW of the work already done in the study of fibroid tumors of the uterus would lead to the conclusion that there is very little left to say about the pathology or clinical manifestations associated with their growth and development. In a larger way this is true but it seems that we still view with complacency some of the complications which while not always serious are nevertheless important and should command our attention. In the absence of other symptoms it has been suggested that the absorption of toxins incident to the growth of fibroid tumors may account for certain changes in the heart muscle which undoubtedly occurs in a high percentage of cases. The final proof of this theory remains for the chemist to determine but in the meanwhile it is important that we as clinicians do not overlook certain changes which under other circumstances are commonly accepted as due to toxic products. The frequency of nervous symptoms oftentimes mild in character but not infrequently severe the relatively large number of cases of infection of the kidney secondary to even small fibroids where there can be no question about the absence of pressure upon the ureter or other causes all point strongly in favor of such theory.

Since Kaprelik in the year 1881 first called attention to the frequency of weakness in the cardiac muscles associated with uterine myomata about 25 articles have been written by gynecologists and surgeons on this subject.

It is the consensus of opinion that heart changes are present in from 40 per cent to 50 per cent of the cases. This has been learned from sad experience oftentimes and there can be no doubt that the severity of the disturbance to heart action in some of these cases during and following operation is secondary only to that which occurs in thyroid disease. In early years paralysis of the heart was given as the cause of death after autopsy had revealed no other excuse.

Fleck made pathological examinations which led him to conclude that brown atrophy of the heart muscle is characteristic of fibroids without hemorrhage and that fatty degeneration is present when profuse hemorrhage accompanies the growth. He also believes that the change in the heart muscle was explained by abnormalities in metabolism. He made a study of 325 cases and found either functional or organic changes in 40.8 per cent. In every instance where an autopsy was made definite cardiac changes were found e.g., fatty degeneration, brown atrophy, etc. He does not believe the heart changes were due to loss of blood because out of 135 cases in which there had been no hemorrhage cardiac changes were present in 34.6 per cent.

In reporting fatal cases where death occurred several days following operation Deaver states: "While some of these deaths may be attributed to shock and exhaustion yet I am convinced that in a number death was caused by pre-existing cardiac and cardio-

renal disease. Boldt in a study of his own autopsies has always found degenerative changes in the heart muscle whether or not the neoplasms had given rise to menorrhagia. He further states that clinical experience teaches that patients with myoma have a weak heart muscle.

Winter insists that an etiological relationship between myoma and heart disease has not been proved and that the heart is influenced only by the secondary anemia due to the hemorrhage which is caused by the myoma. He admits however that 60 per cent of a series of 66 cases where a study of the heart was minutely made showed a myoma heart. Such change in the heart muscle is not infrequently recognized by men of large experience.

Kelly has recently said: "In relation to the uncertainty of recovery following operation in both skilled and unskilled hands there is the ever present dread of cardiac embolism often occurring about the time the patient is superintending the packing of her gown happy in the anticipation of the home welcome. Any operator of experience may appreciate this statement and will agree."

It is perhaps true that sudden death which occurs several days after operation and attributed to cardiac or pulmonary embolism is often really the result of a dilatation of the heart secondary to a weakened muscle. Careful autopsy reports are not often given and a study of the clinical symptoms suggest that the diagnosis of embolism is given because of habit.

No particular form of cardiac degeneration is distinctly attributable to myomata but it is logical to conclude that fatty degeneration is the most frequent change. That arteriosclerosis is occasionally found without any other associated cause is quite evident. We have been interested in a number of cases where there was an absence of hemorrhage or other complications but in whom were found marked clinical signs of a weakened cardiac muscle. The condition was so plainly evident in some instances that it was necessary to keep the patient at rest for several weeks before operation could be undertaken without serious risk. This has occurred when

the tumor was small and under ordinary circumstances would be classified as a so called symptomless fibroid.

A group of symptoms overlooked and often given but scant consideration are those referable to the nervous system. Certain individuals are very susceptible to even the slightest absorption of toxic products. It is for this reason we find such a wide variation in the degree of such symptoms associated with fibroid tumors. Observation would lead to the belief that the type of woman who shows susceptibility to the toxins of pregnancy is also likely to show nervous symptoms from the effect of a growing myoma. The disturbance may be mild but not infrequently it is quite severe and may result in a serious mental impairment. This does not occur in women with stable nervous organization to any serious extent but careful study shows its presence to a greater or less degree in so many instances that it cannot be dismissed without consideration. The frequency with which such symptoms occur secondary to toxic effects in other conditions is well recognized and leads us to conclude that there is no question about the relationship. A study of our histories show the presence of nervous symptoms in cases of so called symptomless fibroids sufficiently often to attract attention. That the toxicity incident to a disturbed thyroid secretion is markedly increased by a growing fibroid is quite apparent.

The frequency with which urinary disturbances associated with fibroids are found is also of interest. The element of mechanical interference with the ureter must always be taken into consideration but casts, albumin and pus occur in a considerable percentage where there is no such pressure. This cannot be assigned as a cause when the fibroid is small or located in such position that it interferes in no way with the ureter. In large growths it may be a factor. For a long time it has been our belief that pyelitis in the early weeks of pregnancy can be due to no other cause than infection which results from a lowered resistance of the individual secondary to absorption of the toxic products of pregnancy. That it occurs in patients with other toxic symptoms and that the severe

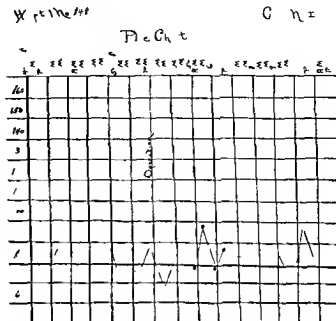
cases occur most frequently in primipara and often in the early week all favor this conclusion

The same effect apparently occurs in fibroids where the individual is susceptible with the result that a most persistent infection of the pelvis of the kidney is produced. We have treated several patients for a chronic pyelitis without any apparent relief who had small tumors of the uterus which in no way blocked the ureter. They sought relief for pain in the affected side and bladder symptoms rather than any symptom directed to the growth itself. In several cases of this kind persistent treatment of all kinds including irrigation of the kidney pelvis failed to cure the infection and it has been our experience that where this condition has persisted for a long time that even after the removal of the tumor the urinary symptoms persist. This is due to involvement of the deeper kidney structure so that eventually if a cure is obtained it is through the removal of the kidney. Delay in early diagnosis as to the cause of such a change in a kidney is therefore, fraught with serious consequences to the patient.

In the briefest way we venture to report a few cases which have drawn our attention to the importance of considering this phase of the subject. The examples given represent the effect upon the heart and kidneys. If space would permit the detailed report of six cases of temporary insanity associated with fibroid tumors would be strongly corroborative. In all bleeding and pressure symptoms were absent and the patients recovered their normal health after the removal of the growth.

Until this problem is solved by a better knowledge of what happens when cells multiply under abnormal stimulation all deductions are purely speculative. Much of our progress has been made by the suggestions offered through clinical studies and without them the chemist would find little inspiration.

It may be that more careful observation of the character of the cells, the lymphatics and blood vessels in these so called benign growths and the correlation of the same with the clinical symptoms in the individual patient



**Chart 1 Case 1:** This chart shows what a mild reaction followed spinal anaesthesia. For this reason it is indicated in case where there is a weak heart muscle.

will lead to a better understanding of this interesting subject

CASE 1 Miss R M Age 45 No 84810 Refer red by Dr Mitchell About ten years ago the patient noticed some discomfort in the lower abdomen This gradually increased in severity until her admission to the hospital There has been no severe pain About five years ago the patient noticed some enlargement in the abdomen (lower portion) and paid little attention to it thinking perhaps it was a normal condition For many years the patient has noticed some shortness of breath on exertion and feels that there has been a gradual increase in the amount of this disturbance during the last few years This symptom was much more marked during the last few months There have been no pressure symptoms aside from some disturbance from the bladder which was apparently due to the presence of the fibroid no swelling of the feet or lower extremities The patient is well nourished and looks apparently well Menstruation began at the age of ten has always been regular flow lasting three to four days There has been some increase during the last year but no free flow No intramenstrual bleeding Examination revealed the presence of a fibroid of the uterus the size of an ordinary foot ball To a casual observer the patient presented the appearance of one in good health The patient entered the hospital for operation The first night she had an attack of pain in the region of the heart and upper abdomen which was undoubtedly due to cardiac weakness The picture was typical of angina pectoris Careful study of the heart showed the presence of a chronic myocarditis with dilatation and some decompensation





sistent pyelitis in right kidney without relief. There was a fibroma of the uterus present which was about the size of a large orange. Aside from backache there were no symptoms referable to the fibroid but the pain in the side and region of the kidney gradually increased in severity. The amount of pus in the urine also increased and there was considerable irritability of the bladder. The fibroid was removed. For the past three years the patient has been in good health and without any urinary symptoms. There are still some pus cells in the urine which show continued impairment of the kidney. The improvement in strength and muscular tone was rapid after the operation showing the marked toxic effect of the tumor.

CASE 7. M. S. L. K. Hospital No. 60650. This patient is interesting on account of having a double pyelitis complicating a fibroma which had given no symptoms. After treating the infection for several months without any improvement it was decided to remove the tumor which was no larger than a grapefruit. There was considerable impairment of kidney function and marked irritability of the bladder. A hysterectomy was done June 5, 1909. Since the operation the patient has made wonderful improvement in a general way. While there are still some urinary symptoms occasionally they are infrequent and mild in character. There is pus in the urine at times but no distress in the bladder.

It has been our experience in these cases of chronic pyelitis, when not dependent upon some mechanical factor that complete recovery seldom occurs from any form of treatment.

CASE 8. Mrs. M. K. Age 38. No. 0883. Referred by Dr. Sherrill. The patient as last seen in June 1906. Examination at that time revealed a pyonephrosis of right kidney and abscess of the

uterus. On account of severe illness a nephrotomy was done and the kidney drained. The patient improved but did not fully recover and the kidney was removed June 3, 1906. At that time the fibroid had increased somewhat in size but it was not considered safe to remove it. The urine from the left kidney was negative. The patient returned for examination in April 1909. She complained of some discomfort in the region of left kidney with occasional discomfort in the bladder. There were a few pus cells present in the urine. The fibroid had doubled in size. It was apparent that the pelvis of the left kidney was slightly infected. Fearing serious change in the kidney the fibroid was removed May 2, 1909. From the study of the symptoms and previous history we concluded that the infection of the kidneys was the direct result of the toxic absorption incident to the fibroid tumor. There was no hemorrhage and the fibroid was symptomless except for the general evidences of toxæmia which was exhibited by considerable anemia and chronic fatigue.

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# THE ORIGIN OF THE INTRAPELVIC TREATMENT OF THE STUMP AFTER SUPRAVAGINAL HYSTERECTOMY FOR FIBROID TUMOR OF THE UTERUS, TO WHOM BELONGS THE CREDIT?

By J. RIDDLE GOFFE, A. M., M. D., F. A. C. S., New York

I VENTURE the opinion that in the whole range of gynecological procedures there is no operation dealing with an equally serious condition that is attended with so little loss of life and is fraught with so much satisfaction to both patient and operator as supra vaginal hysterectomy for fibroid tumor. Today it is the accepted standardized operation in practically every surgical clinic throughout the world. It has made it possible for example as recorded by Dr. LeRoy Brown to operate upon 262 cases of fibrosis by this method in one year viz 1918 at the Woman's Hospital New York with a mortality of 4 patients or 1.5 per cent and that too by the entire staff of at least 15 operators. This stands out in striking contrast to the record of a similar number of distinguished operators as presented by Knowsley Thornton in 1882 by the old method showing 202 cases and 80 deaths a mortality of 38.67 per cent.

The credit of inventing such a procedure is an honor worth guarding with jealous care. In some clinics it is spoken of as the Baer operation and by many believed to have been invented by him. It is not surprising that in the addition to the armamentarium of surgery of so valuable a procedure any one who has taken any part in contributing to its development and perfection should claim recognition for his work and in his enthusiasm overstep the bounds of what may be his just due. The supreme honor of having one's name the dominant one in such an achievement however should not rest upon a non essential modification or refinement of detail. The question is who had the good fortune to conceive the idea plan the details to make it practicable and safe and finally the courage to carry it into execution and demonstrate on a living subject its safety and its virtues?

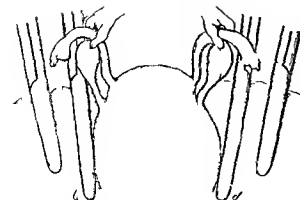
Published records show that after having devised the scheme of the operation and hav-

ing gone over in my mind many times during the succeeding years the successive steps of the procedure I ventured to apply it in the case of a living woman at St. Elizabeth's Hospital New York May 29 1888. The patient made a prompt and excellent recovery leaving the hospital at the end of the fourth week. I was assisted at the operation by three well known New York surgeons who have testified to the occurrence and the truthfulness of my report. This was indeed a triumph. I had dared to drop the pedicle into the peritoneal cavity and that too with impunity. Hemorrhage was perfectly controlled so that the patient lost no blood either at the time of operation or subsequently. To be sure slight suppuration had occurred but the peritoneal cavity was protected against infection by the peritoneal flip and drainage was promptly and efficiently secured through the cervical canal. The patient had convalesced as comfortably as after an ovariectomy. Three cases succeeded this in rapid succession all attended with prompt and satisfactory recovery.

Here then was an entirely new and original method embracing untried features and meeting all the requirements of a perfected surgical procedure. First and foremost it solved the problem of dropping the pedicle and closing the abdominal incision without drainage. Second it covered all raw surfaces with peritoneum. Third it fastened the infundibulo pelvic and round ligaments to the stump and conserved the attachments of the cardinal ligaments thus preserving the supports of the pelvic diaphragm and lastly it restored the pelvic organs to their normal positions and relations in the pelvis disposing of all traumatic tissue with the nicety of a plastic operation.

I wrote a careful description of the operation in a detailed report of the four cases and presented it in a paper before the Obstetric and Gynecologic Section of the New York





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Academy of Medicine March 1890. It met with most cordial approval and many complimentary remarks by the Fellows of the Academy who discussed it. The paper appeared in April 1890 in the *American Journal of Obstetrics and Diseases of Women and Children* with the illustrations which are reproduced here. The operation was employed later by Dr Janvrin Dr George Tucker Harrison Dr A P Dudley and others with satisfactory results thus establishing it as a recognized procedure.

In September 1892 four years and five months after my first operation and two years and four months after the publication of my paper Dr Baer of Philadelphia read a paper before the American Gynecological Society in which he reported 10 cases of fibroid tumor with one death operated upon by what he claimed to be an entirely new and original operation. Now on careful analysis the operation in its essential features was my operation simply modified by transferring the



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main ligature from the cervix to the uterine vessels in the broad ligaments. In my fourth case (see original report) I ligated the ovarian arteries in continuity in the broad ligaments and one uterine artery. Dr Baer followed me in this but he went me one better and ligated both arteries in the broad ligaments thus doing away with the ligature on the cervix.

While this modification was a refinement in the one detail of my original operation which I gladly recognized and adopted it was not essential to the success of the procedure for while Dr Baer reported 10 cases with one death my first series detailed 4 cases with no death and my second publication recounted 17 cases with 1 death. It was therefore a modification of one feature of my operation a refinement to be sure but of minor consideration in comparison with my original concept its audacity and its perfection of detail. I therefore claim precedence as the inventor of this operation. If any one's name is to be attached to it it should be known as the Goffe operation.

## ACTINOMYCOSIS OF BOTH OVARIES AND FALLOPIAN TUBES

THE REPORT OF A CASE OPERATION AND RECOVERY WITH A TABULATION OF ALL THE CASES OF ACTINOMYCOSIS OF THE FEMALE GENITALIA RECORDED IN THE LITERATURE

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## FREQUENCY

THE invasion of the human body by the ray fungus was first described by Israel (1) in 1877 just one year after its discovery in bovines by Bollinger ( ). Since then many studies dealing with the bacteriology, the pathology and the clinical course of the disease have from time to time appeared in the literature. No tissue seems to be immune and among the rarest to be affected is that of the female generative organs.

Illich (3) in a study of 41 cases of actinomycosis in man has found its distribution in the following order: 51.8 per cent of the neck, 13.8 per cent of the lungs, 21 per cent abdominal (chiefly intestinal), 6 per cent of the skin and the rest undetermined. Harbitz and Grandel (4) have collected 87 cases among which 45 per cent involved the cervical fascia, 3 per cent the respiratory organs, 30 per cent the intestinal canal and 2 per cent the skin.

In neither of the above quoted reports is there any mention made of genital actinomycosis. Kohler (5) states that up to 1914 25 cases of actinomycosis of the genitalia have been recorded. My investigation resulted in a collection of 19 cases only. The reason for this variation in numbers is due to the fact that I have endeavored to include only those cases where the diagnosis has been proved and where the involvement has actually been of the reproductive organs.

## THE POINT OF ENTRY

How does this bacterium gain access to the tissues? According to Israel (1) the most favorable routes of entry are in the order of their frequency: (a) the mouth, (b) the respiratory tract and (c) the gastro intestinal canal. Bostroem (6) has added a fourth avenue of invasion (d) the skin.

## PATHOLOGY

Having lodged in the tissues, how does this organism spread? Does it take place by continuity only or does the blood stream assist in its further distribution? What factor if any does the lymph current play in this role?

The two first named agencies are about equally potent. MacFayden quoted by Berry Hart (7) believes that the cocci are carried by the plasma having found their way into the blood current by breaking through the blood vessel walls. That this is the case may be readily appreciated from the pathological changes wrought by the ray fungus. In its spreading this organism does not follow any definite anatomical landmarks such as fibrous or muscular planes but proceeds in a lawless fashion ruthlessly destroying every tissue in its path. It produces complete necrosis and suppuration, the formation of excessive granulations and the replacement by connective tissue to so marked a degree that the original morphology can hardly be recognized macroscopically and at times not even microscopically. My own case the pathology of which I shall discuss later serves as a concrete example of these findings.

Regarding the importance of the lymphatic channels as carriers of this infection the consensus of opinion is in the negative. For in none of the cases observed have the lymph nodes been found to be enlarged. Should a case of actinomycosis present lymphatic involvement then it would only mean that the lymph glands were invaded by continuity the same as any other tissue that chanced to be in the path of the invading mycelium. The hypertrophy of these glands could in no sense be interpreted as a defensive response such as is witnessed in tuberculosis and malignant affections.

TABULATION OF ALL CASES OF ACTINOMYCOSIS OF THE FEMALE GENITALIA RECORDED IN THE LITERATURE UP TO DATE

| N | Y   | A h     | S  | A | D |   |   | F m ry Fac                                 | P t f G t l  | T E |   | R I |   |   |
|---|-----|---------|--|---|---|---|---|--|--------------|-----|---|-----|---|---|
|   |     |         |  |   | D | E | L |  |              | O   | P | C?  | I | D |
|   |     | m       | W m d f h b p                                      |   |   |   |   | Th l i h d p d<br>h i l i h m l<br>h p y h | R h f be     |     |   |     |   |   |
|   |     | m E C d | W m l J h b p<br>A h f k l (h b l<br>E J b H p R   |   |   |   |   | z m  | f f be ry    |     |   |     |   |   |
| 8 | R   | b h A   | W f k l W h seb l                                  |   |   |   |   | g  | U f be       |     |   |     |   |   |
| 6 | S   | H bel A | P h l p h A  |   |   |   |   | m)   | S h ov       |     |   |     | ? |   |
|   | S S | l       | J l b R se d                                       | ? |   |   |   |  | U            |     |   |     | ? |   |
| 8 |     | l J     | l h f b h  |   |   |   |   |  | B h          |     |   |     |   |   |
|   | oo  | l       | L sch m d W h sch                                  |   |   |   |   |  | R h ry       |     |   |     |   |   |
|   | H   |         | i l my d   |   |   |   |   | f d  | Le f d       |     |   |     | ? |   |
|   | H   | l rv    | f l f f f I  |   |   |   |   | ?  | l f ry       |     |   |     |   |   |
|   | k   |         | Fmp t Ak my k x d<br>W b l h d Ad h A b<br>d l k l |   |   |   |   |  | R h ry       |     |   |     |   |   |
|   | V   | y J     | h h d l sch p t                                    |   |   |   |   | l m  | U t ru b     |     |   |     |   |   |
|   | hl  |         | h h d l h i h                                      | 8 |   |   |   | l b  | U f d        |     |   |     |   |   |
|   | hl  |         | h h d d b h  | 8 |   |   |   | f m ll                                     | r be ry      |     |   |     |   |   |
| 6 | oo  | i mm    | h h d d b h  |   |   |   |   | ?  | ll f ry t be |     |   |     | ? |   |
|   | oo  | h h se  | sch m d W h sch                                    | 6 |   |   |   | Ap l m f m                                 | h ry         |     |   |     |   |   |
| 5 |     | h T E   | N oc R M l   |   |   |   |   | Appe l                                     | f ry ry      |     |   |     |   |   |
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## DIAGNOSIS

I am chiefly interested in the abdominal type of the disease and I am in full accord with those observers who claim that not until the tissue obtained at operation is submitted to pathological examination or the pus derived from a persistent sinus or an incised abscess is bacteriologically studied can a diagnosis be established. It is seldom indeed that the trained surgical eye can detect the yellow granules in the suppurating foci.

The clinical course of the disease does not help us materially in arriving at a diagnosis. The onset is insidious in character, the temperature is as a rule of a low type unless the infection becomes mixed; there is no lymphatic involvement and the agglutination and the matting together of the abdominal and the pelvic viscera only serves to make confusion greater.

The two diseases for which actinomycosis is as a rule mistaken are tuberculosis and malignant neoplasia. But if we bear in mind that the former is from its very inception accompanied by a typical temperature curve and that the latter invariably invades the lymphatics if we bear these two facts in mind they may serve us as important points in the differential diagnosis.

Another clinical fact which seems to me is of diagnostic value in cases of ovarian actinomycosis is the early onset of amenorrhea. Amenorrhea is also a concomitant symptom in tuberculosis but there it is due in the main to the general debility of the individual and not to the tubercular affection of the ovaries *per se*. All of the cases of tuberculosis of the internal generative organs which came under my observation failed to present menstrual cessation as one

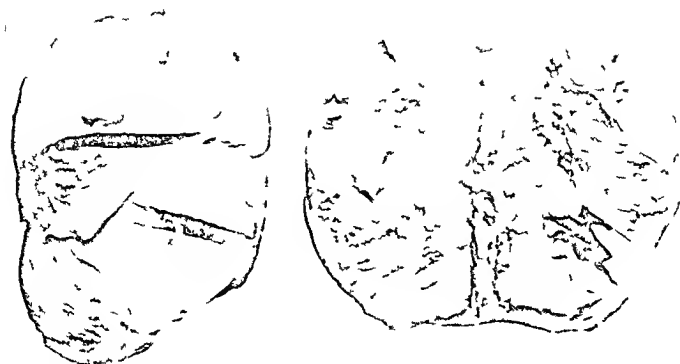


Fig. 1. Photograph reproduction of the ovaries reduced one sixth. At left tumor closed; at right the appearance of tumor on cross section.

of the clinical phenomena. On the contrary some of them suffered from menorrhagia or irregular menstruation and those upon whom I have operated and in whom I have endeavored to preserve one or part of one ovary on account of their youth the menstrual function has been retained for periods varying now from 1 to 3 years and longer.

I can speak with equal certainty regarding the relation of menstruation to malignant growths of the ovaries. The few cases of this type upon whom I have operated did not present symptoms of ovarian hypofunction. They suffered rather from excessive or irregular menstruation. These clinical facts are in full accord with the pathological data. For it seems that neither tuberculosis nor carcinoma or sarcoma of the ovaries destroy the tissues of these organs so completely and rapidly as does actinomycosis; hence the reason for the early appearance of amenorrhea in this group of cases.

#### PROGNOSIS

Although the outcome in my case is thus far favorable, the opinion of those who have had a more extensive experience with ab-

dominal actinomycosis is most unfavorable. They do not consider a case cured until two or more years have elapsed from the time of operation.

#### TREATMENT

In my patient the treatment was chiefly surgical. I have also had recourse to the much lauded potassium iodide which I administered in doses of 80 to 90 grains per day but without success. For every time that the patient was given potassium iodide the temperature would rise and on its withdrawal it would invariably return to its former range. Recently radium and roentgen ray therapy have been advocated as well as vaccines.

B. S., age 15, was referred to me on June 4, 1918, by Dr. Hymanson on account of pain in her lower abdomen from which she had been suffering for nearly three weeks and which would become aggravated on exertion.

*Menstrual history.* She began to menstruate at the age of 11 years and 6 months; menstruation was irregular in type occurring every 6, 8 to 10 weeks. The amount was always profuse, lasting from 6 to 8 days. Her last period had occurred three and a half weeks ago but the amount was very scanty; the flow had lasted only a few hours. The period preceding the last one was also markedly diminished in amount.

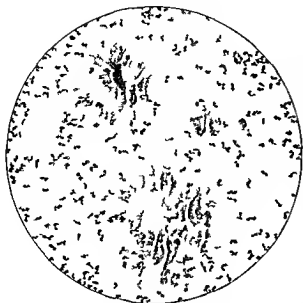


Fig. O. t. wh. h. d. g. m. p. l. t.  
d. t. t. t. l. g. l. t. m. h. g. b. e. p. l. e. d. y.  
d. t. t. t. f. m. t. d. t. p. p. r. a. t. n.  
M. > g. p. f. t. m. y. f. d. u. d. t. h. g. l.  
t. n. g. u. l. f. h.

*P. c. ill. ses.* At the age of 8 months she was taken ill with spinal meningitis resulting in a permanent paralysis of the left upper and lower extremities and an undrained abscess of the entire left half of her body.

*T. l. p. r. s. t. l. t. b. g. a. n. 3. e. e. k. a. g. o. \. t. h. n. d. f. n. t. p. a. n. s. n. t. h. l. a. b. d. o. m. i. n. a. l. v. h. c. h. r. d. u. s. t. y. g. r. e. \. o. e. p. a. t. u. l. v. o. n. e. v. e. r. t. o. n. \. f. r. s. o. m. e. t. m. e. p. r. e. l. g. t. h. e. s. e. s. y. m. p. t. m. s. p. a. t. i. e. n. t. e. m. p. h. n. d. o. f. g. n. e. l. e. a. k. n. s. a. n. l. a. n. o. e. a. \. s. h. e. h. i. l. n. o. c. h. i. l. l. o. r. e. f. e. r.*

*H. v. c. l. i. n. t. o. n.* She presented the appearance of a normally developed girl for her age. The secondary and tertiary characteristics were normal. The uterine development of the entire left side of her body including the left mammary gland was well developed and equal to that of the right half. On abdominal palpation a small, firm, tender tumor occupying the left pelvic fossa. This mass was fixed in position and the uterine fundus was attached posteriorly to the anterior abdominal wall and it was connected to the right ilio-psoas area. The uterus and the uterine body could be felt but it was impossible to palpate the adnexa. Her temperature was 99°F, pulse 80 and respiration 20. Heart and lungs were negative.

On June 4, 1908 the patient was admitted to the Beth Israel Hospital on my service and on the following day I performed an exploratory laparotomy.

*Operative findings.* The mass in the left pelvis was exposed by the gonioflexure of the mesentery

of which was excessively thickened due to inflammatory changes. It was displaced to the right and not only adherent in part to the abdominal parietes inferiorly and to the fundus uterine posteriorly. The rest of the pelvis and the abdominal contents were normal in appearance. On attempting to separate the mesosigmoid from its points of adhesions to the left pelvic wall several necrotic masses were noted from which a thick purulent material exuded mixed with necrotic debris. Considering the condition as one of tropical abscess, I decided to refrain from further manipulations and after inserting a drainage tube to the upper part of the focus I closed the abdominal incision by layers. The pathological report upon the tissue removed for examination was as follows: *P. t. p. e. t. c. o. u. s. e.* The patient remained in the hospital for one month running an almost febrile course during the entire period. On July 3, 1908 she was discharged with the abdominal cavity healed except at the lower angle where small sinus persisted. The diagnosis at this time was still in abeyance.

On December 5, 1908 the patient was readmitted to my service. Her mother stated to me that shortly after the patient's return home her condition had changed for the worse. The temperature began to rise every evening to 102° and 103°F accompanied by profuse perspiration, progressive loss of appetite, anorexia, vomiting, and total amenorrhea. On examining the abdomen I found that the laparotomy scar had broken down in several places, from which pus was exuding. Probable evidence of abscesses some of them subcutaneous others leading to much deeper levels into the abdominal wall. On these abscesses extended into the abdominal cavity to a depth of nearly 5 inches. The temperature was 102°F, the pulse 120, the respiration 28. The blood examination showed an hemoglobin index of 60 per cent, red blood cells 3,600,000, white blood cells 20,000, polymorphonuclear 8 per cent.

On December 19, 1908 under general anesthesia I explored these abscesses and found none but a mass of pus measuring 7 by 4 inches in diameter. On removing the pus the body of the uterus was quite virginally the deep layers of the abdominal wall and the superficial ones packed them and returned the patient to her bed. I expected that from now on her condition would improve but instead the suppuration became more and more profuse the temperature continued to rise still higher and the general condition grew steadily worse. After examination by the ecto-abdominal route I decided that the pelvis contained several indeterminate tumor masses. I decided to reoperate.

On January 9, 1909 I reoperated on the abdominal cavity with the original incision. The omentum was found adherent to the lower half of the abdominal wall and to the pelvic contents. After separating the omentum from the underlying structures



Fig. 3. Cross section of fallopian tube showing acute inflammation and clumps of actinomycetes within its lumen.

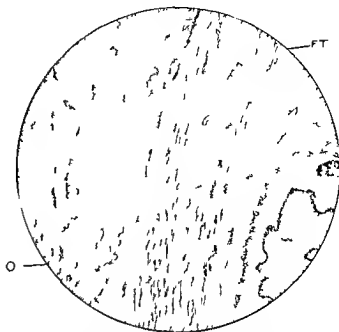


Fig. 4. Section containing besides part of the fallopian tube (ft) also a remnant of ovarian tissue (o).

the uterus came into view. The fundus was fixed to the parietal peritoneum in front and to either side of it a globular or rather kidney shaped tumor the size of a fist was present. Each of these tumors was invested with a distinct grayish looking serous covering and in spite of the fact that they were intimately adherent to the surrounding structures I succeeded in removing them *in toto*. What struck me as rather unusual during the operative procedure was the fact that although these adhesions were dense and apparently well organized very little bleeding followed their disintegration. There were very few blood vessels indeed that required ligation. Before inserting my drains preparatory to the closing of the abdomen I orientated myself upon the fact that besides the uterus no other internal organ of generation was left in the pelvis. Her postoperative course for the first week was rather stormy thereafter however she began to improve and on February 2, 1919 she was discharged apparently cured.

#### PATHOLOGICAL REPORT

**Gross appearance.** The tumors are about equal in size measuring  $3\frac{1}{2}$  by  $2\frac{1}{2}$  by 2 inches and in contour resemble the kidneys (Fig. 1). They are grayish yellow in color and each of them has a smooth glistening serous capsule which can in part be peeled off. On cross section the surface presents an uneven wavy appearance consisting of trabeculae inclosing in their meshes numerous milium abscesses. The slightest pressure exerted on the periphery of the tumor causes droplets of thick pus to come to the surface.

**Microscopic description.** Sections were taken from different parts of the tumors hardened and

stained with hematoxylin eosin and also with Gram Weigert. The microscopic appearance obtained was that of tissue which has undergone complete suppurative degeneration. The masses of necrosis which consist of debris pus cells and round cells enclose many hyaline clumps of numerous threads which radiate from a center in a fanlike manner with club shaped extremities (Fig. 2). To establish definitely the identity of the organs removed additional sections were made and fortunately I obtained cross sections of the fallopian tubes which in the gross specimen could not be recognized on account of their intimate adhesion to the tumor. These sections show that the tubes are in a state of acute inflammation. The mucosal folds are markedly hypertrophied the stroma is infiltrated with round and pus cells. The columnar ciliated epithelium is wanting in many places and within the tube lumina masses of necrotic material are found which surround clumps of actinomycetes (Fig. 3). Other sections also show remnants of ovarian stroma as seen in Figure 4. I was also able to find in some areas remnants of atretic follicles.

#### CONCLUSIONS

1. The macroscopic study proves beyond a doubt that the tumors removed from our patient are the ovaries and the fallopian tubes.

The involvement of the mesosigmoid only as was found at the time of the first operation leads us to believe that the primary focus was the lower bowel.

3 The infection of the internal generative organs as proved at the second operation six months later excludes the possibility of a primary genital infection

4 The location of the actinomycetes colonies both within the tube lumen as well as deep in the ovarian stroma and not immediately beneath the germinal epithelium or upon it speaks for the possibility that the spreading of the infection has proceeded both by continuity and by the blood stream

5 The absence of enlarged retroperitoneal, mesenteric and inguinal lymph gland at both operations and since operation ex-

cludes the lymph current as a carrier of actinomycotic infection

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- d M l L l p l l A t 80 8
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## RUPTURED UTERUS OCCURRING TWICE IN THE SAME PATIENT

B EDWARD I CORNILL BS MD CL A  
A d Of Ch L I H I J D J P I H I

**B**ECAUSE of the unusual interest I would report the history of a case in which rupture of the uterus occurred twice

Mr J C c l e l a g e came to the St L u k s Clin f th Ch r c l n g l H p t a l a n d D i p e t t t h i x t h m o n t h o f h e j r g n a n y S h g e t h f o l l o n g h i t r t t h t i m e H f i t h e r u l t h r e l n g l a l l S h h i d n o i t e o r b r o t h e r S h e l a t h j r k e t l e n h i l d S h d i d i t a l k u n t l s y s j S h b l a r t f e r t 6

I q h o p a t l u p o n t S t L u k s H o p i t a l f o r t h r e n e l u p t e o f t l e u t u T h u t u w a f u n d t h e n t a l n d i h f h l e d f r d i A c l s c l e a r a t o n w a d o e O J u l y q h e n t e n t o l a b f r t h e s e c o n d t i m e T h i t i m e a d a o i o f r p t u r e d u t e r u s v a s m d e l i t h e r c l i c l a s a n w a s p e r f o r m e d a t S t L u k e H p t l s a l h u r f i l a o h e g a n T h e b a b y v a d d e l e f e o p e r a t i S h m a i l g o o d r e e v

The pat nt prol b h n s h v a s 6 T h e y c r e o t 4 d a y s d t n 28 d a y t y p e i t h n o p a i n T h e l a t p o d w i n J a n u a r y 98

O v m a i o n i t f o u n d t h a t h e a s x m o n t h s p r e g n a t H e b l d p r u r a n d u n e v e r n o r m a l H e p e l v i c m e a s u r e m e n t s e r e s p i n 6 3 c e t s I r c h a n t e s 31 b a u d e l o c q u e r 6 5 c o n j u g a t e d g o n a l i s T h e p r o m t o r y v a s v e r y e a s i l y f i t T h e v a i n a l o p e n i n g a s e r v s m a l l a d m i t t i n g l o n g e s w i t h d i f f i c u l t y T h e t u b e a

i c h e e l t t h e r T h e a c t m e a u e m e n t a n t t k n

T h p i n t m p l i n e d o m e h a t f p i n i n t h e s t e o f t h l l s c b u t t h e s n m a l S h e p t d t i c l i c f r e v n n a t a n d e e r t h i g a l u n d t o b e g o n g n n r m l l y S h e a i n t r u c t e d t r e p o r t t l i n t H s p i t l o n t h f i r s t o f S e p t e m b e r m i n t l i s h t t e d i n l a b o r S h e d i d n t d a h e v i s i n t t d

O c t o b e r t a m h e b e n t h i e p n t h e l o a b l o m e n h i h c a m p l e t h a r a t a i l h u t h l f h u r p a r t A t 4 p m t h e p a n t i c m e s e a n t h e c u l l i h d i v a l k S h e h a d o n h e r a t t a k o f p a n t u t h l i n t e m n l h n t h u p t u e i k p l a c e S h e t u g h t s h e f i t t h e l a b y m e l i t e i t h e a f t e r n o n a d e n A t 6 p m h e d e c i d e d t o g o t t h h p t a h i t g h t s h e v n l b

O n e n t a c a t o p m t h p t i n t s h o e d l i n c e o f a b d m n a l h a x m h a g T h f c p a l l i h p l s e m a l l n o l u m e a n d a p d T h b d o m a s d i s t n d e d d v e t e n d I t m p o l l t p u l p t e n y t h g A f e t a l h r t t e o l d l e h a d T h e p r e a t o n c u l d t b e m d u t S h e a s h a i g p a n a b o u t 3 t 3 m t s p a r t T h e c n o a g i n l d s h a g A d g o f u p t u r d u t e r u w a m d e a n d t h p t t p p e d f o r o p a t n

A t p e a t o n t h u u l a b d o m i n a l i c s i o f r l a s s e l x a a s e c t i o n a s m a d e F e e l l o d e n c n t e d e s o o n a t h e a b d o m s s p e d C i t s e r e a l e e n T h s a d e s d h i o n l t e n t h l d b d o m i n l s d t h u t c a T h e a l h e i s m a d u p o f o m e n t m n d s e

tissue This was severed and the uterine scar came into view The rupture was located in the old scar and was about 8 centimeters long The placenta filled the gap It was covered with blood clots The hand was passed through the placenta to the sack which was intact The child was in breech presentation back on the left Delivery was made in the usual manner and the child was found to be in state of rigor mortis The head was bent and fixed to the left The uterus contracted down nicely The placenta was delivered followed by the usual prolonged cesarean operation The operation was practically bloodless The abdomen was closed in the usual manner A direct salt solution transfusion was given Patient was pulseless for a short time but soon revived She was put to bed in fair condition

She ran a stormy career for about 6 weeks During

this time a rather large abscess developed in the pelvis on the right side and also a severe bronchitis There was a marked infiltration of both apices so much so that an internist made a tentative diagnosis of pulmonary tuberculosis

The abdominal abscess opened through the lower end of the abdominal scar and through the cervix Three days later the temperature dropped to normal and patient went on to recovery She was discharged from the hospital 9 weeks after the operation Examination made four months later showed the abdominal contents to be normal The patient had gained in weight and was doing nicely

The last examination was made in April 1919 At that time the pelvis was found empty No trace of the old abscess was found The patient was doing light housework without difficulty

## ABRUPTIO PLACENTÆ ASSOCIATED WITH SPONTANEOUS RUPTURE OF THE UTERUS

WITH REPORT OF TWO CASES

By LOUIS C. PHANEUF, M.D. Boston

IN searching through the recent literature for any reference to cases of premature separation of the placenta associated with spontaneous rupture of the uterus for my own information I was unable to find any mention of this condition In the course of 15 months two such cases have come under my observation and seem to be of sufficient scientific interest to make them worthy of report

CASE 1 Mrs M I para I age 33 married 10 months confinement expected April 15 1918 The patient was seen in consultation with her family physician at one of the local hospitals March 3 1918

The family and previous histories were negative and the patient was well throughout her pregnancy up to the present time In the afternoon of March 3 1918 she rode in the street cars the jolting there received causing her to start bleeding The first signs of hemorrhage were noticed at 5 30 p.m. She was first seen by her physician at 7 30 and taken to the hospital directly I personally saw the patient at 8 30 the same evening

On examination she showed signs of marked exangination the pulse was rapid thready very poor in quality and at times was felt with difficulty The patient was blanched and in extreme shock The uterus was firm tense painful to palpation

and the size of a large term pregnancy There was no dilatation of the cervix labor pains were absent and the fetal heart tones were not heard

Because of the marked hemorrhage and the lack of dilatation of the cervix it was decided to perform a laparotomy

Operation Under light ether anesthesia the abdomen was opened by a four inch incision using the umbilicus as a mid point the incision being made on the left side On opening the peritoneal cavity considerable bloody fluid gushed out the incision was enlarged downward and the uterus found ruptured in the median line halfway between the cervix and the fundus The rent was through the peritoneum and muscularis but not through the endometrium The rupture covered an area about 2 inches in length and the patient was bleeding freely into the peritoneal cavity from this

Since the tear was longitudinal and in the median line the endometrium was incised over the ruptured area and the incision in the uterus enlarged upward A small stillborn female fetus corresponding in size to about a seven and a half month pregnancy was delivered by breech extraction The uterus was filled with large clots which were removed Half the placenta was separated this was quickly removed together with the membranes The presentation was cephalic the position was not made out The uterus was sutured in two layers the first interrupted including cervix and muscularis but avoiding the endometrium the second a continuous Lembert suture including the peritoneum



and part of the muscle and covering the deep suture. No chromic catgut was the suture material used. The abdominal cavity was freed of blood clot and liquor amni as much as possible and the abdomen closed in three layers with iodized catgut and silk suture. Two millimeters of parietal r were used one in the skin incision the other after emptying the uterus. The time consumed in operating was 7 minutes the amount of ether used 4 ounces.

The patient pulse was hardly perceptible during the first part of the operation. However, it improved gradually when the bleeding was controlled. She made a quick and good recovery. Was given subcutaneous salt solution. The Murphy drip and morphine in small doses to overcome her restlessness.

From March 4th to 6th the patient's condition was peculiar with pains of the abdomen with out temperature.

March 7, 1918. At 9 a.m. the temperature was 99° pulse 144. Patient marked patient much. She said at this time that she was in the operating room where the silk suture was removed. It was found that on account of the distention of the fundus and the peritoneum had separated underneath the skin which had healed. Both the small and the large intestine were enormously distended but there were no signs of peritonitis. Local incision in the incision as made in the right flank a distended cecum was brought up, pushed, trilled, the iodized catgut opened and a Murphy tube inserted. There was free drainage of liquid to the extent higher level of distention. The first incision a little through and through silk suture. The patient at this time transfused by the citrate method from her 75 cubic millimeter of blood in 15 minutes. She died during the day. At 8 p.m. the temperature was 100° and the pulse 138. There was no change during the night.

March 8, 1918. At 6 a.m. the patient gradually became weaker and died at 9:30 the same morning. The case is almost hopeless from the start. Not yet the patient's condition treatment. The first 10 days the hope of a successful result is uncertain. With the onset of distention on both sides, which is done in the hope of relieving it, probably of no permanent value.

CASE 2. Mrs. A. K. para 1 married month confinement preceded about April 5, 1910. All went down to my service at St. Elizabeth's Hospital April 26, 1910. The family and past history were irrelevant. The menstrual history as normal.

The patient was admitted to the hospital at 9 p.m. having moderate pains her pulse 68. At 3:45 a.m. April 7, 1910 I was notified that she was bleeding slightly and that her pulse was 90 and of good quality. The fetal heart had not been heard. I saw the patient at 4:45 a.m. her pulse 110 and her pulse was 120 thready and of poor quality. She was bleeding freely per vaginam. The uterus was tense and to the vaginal examination the

cervix was not taken up. There was no dilatation and the vertex was presenting in left occipito-anterior position.

An immediate abdominal delivery was decided upon on account of the hemorrhage and the long rigid cervix without dilatation.

Operation. Ether anesthesia. A median suprapubic incision on about 4 inches long as wide. On opening the peritoneal cavity a rent about 2 inches long running obliquely from the fundus to the right tub was noted. The extended through the serosa and muscula is but not through the muscle. The uterus was incised in the median line there being practically no bleeding from the cut surface. All the placenta was practically all packed. A small tillobo fatu in term as indicated by the beehive placenta membranes and the cervix emerged and the cervix dilated from 1 to 2. The uterine incision as situated in the layers with No chromic catgut. The first layer a suture and took in the serosa and muscula coats and in the muscle the second layer consisted of a continuous Lembert suture which took in the serosa and a little of the muscle and covered the first row of interrupted sutures. The uterine incision was repaired with figure of eight suture of No 2 chromic catgut. No attempt was made to remove the blood or fluid from the peritoneal cavity. The abdomen was closed in the layers using iodized catgut and silk suture. The time consumed in operating was 30 minutes.

The patient made good recovery. She was given 800 cubic millimeters of salt solution under the beas as well as hocke emulsion. The Murphy drip was started and she was returned to her bed and she was given a normal diet to keep her quiet. At 4 p.m. the pulse was 90 and of decidedly better quality.

April 8, 1910. The morning temperature was 99° the pulse 90 and of good quality. The patient looked better and felt better. A high compound nematic was given in the afternoon. On May 9, 1910 the evening temperature was 99° and the pulse varied from 90 to 100. The abdomen a soft, there had been no distention and the blood had returned to the natural position. She had it was ordered May 9, 1910 the patient's gain in weight rapidly the temperature varied from 99 to 101 in the evening and a normal morning. The pulse varied from 80 to 90. She was allowed to sit in a chair for short time. May 16, 1910 the evening temperature varied between 100 and 101. The second day after the normal May 23, 1910 the temperature has remained normal all day and the pulse 118. Discharge. The abdominal incision well healed through out the normal on tenderness vaginal examination the cervix closed the uterus well involuted and the position the adnexa normal and the parametria no sensibility.

May 3, 1910 discharged well on the twenty sixth day after operation.

## TEMPORARY STERILIZATION OF THE FEMALE

By Dr. AUGUSTO TURENNE, MONTEVIDEO, URUGUAY

P l I C l 1 0 b t t M d F l y f m d

THE voluntary limitation of procreation is a problem which no doctor can afford to neglect at the present time. The evolution of customs, the progress of social organization, the profound changes which take place in legislation, the modification which a multiplicity of factors impress on the constitution of the family, make necessary the profound consideration of means for bringing into accord interests which appear to be diametrically opposed without departing from the capital precepts of professional morality.

Neo Malthusianism, even in its excesses, shows the necessity for studying its origin, its development, the means of combating its extreme views, and more than all, of delving into it for the secret but irresistible cause to which is owed the diffusion of the practices which constitute its application.

It is for these reasons that I believe we ought preferably pay attention to the means which upon previous mature reflection we should advise in particular cases.

The disadvantages of the anticonceptual practices most frequently used have been largely studied, especially by the European anti Malthusians, who for the most part mask nationalism and an aggressive militarism with abundant verbiage about an apparent high morality. There is no doubt, however, that the violation of the natural laws of copulation, of which *coitus interruptus* is the type, brings on serious danger of nervous inequilibrium in both sexes and such psychic disturbances as the unfortunate Professor Bossi has described with singular mastery, although perhaps in a manner unduly detailed. The use of substances fatal to the spermatozoa is impracticable especially in the customary mode of conjugal life, and mechanical means of cervical occlusion, in particular the intrauterine pessary, are dangerous, often giving rise to uterine cancer, in the etiology of which traumatism and infection seem to be pre-

ponderantly important, and this is brought on by the trophic epithelial deviation with a rigid stem which permanently irritates the mucosa. Most men find it difficult to use a condom. Aside from the indications of the interested individual, order to which the physician ought not to listen, there remains a group of indications for which the occasion for sterilization of the female can be considered.

The progress in pathology and obstetric technique daily reduces their number but aside from irreparable or definite situations, there exist circumstances in which an affection susceptible of contra-indicating pregnancy or childbirth temporarily is cured or rather the contra-indication disappears. Nor must the cases be forgotten in which a marital psychosis can justify a temporary sterilization which would have no reason for being in the event of the death of a sick husband or in case of divorce.

The procedures which have been used heretofore have the disadvantage of sterilizing permanently, and when they have not done so it ought not to be laid to the operator, to these last belong ligation and simple section of the tube. More radical are tubal resection between two ligatures, resection of the proximal tubal end and a wedge out of the cornu of the uterus, the resection of the ostium with a piece of the tube and its inclusion between the layers of the broad ligament and the extraperitoneal fixation of the tube in the inguinal canal of the round ligament. While these procedures produce definite mechanical sterilization, they are accompanied with relative frequency by degenerative disturbances of the ovary, no insignificant matter if the capital endocrine function of this organ is taken into consideration (Borde, Mandl, Buerckadt, Kehrer).

Every procedure for temporary sterilization should according to our opinion meet the following requirements:

1. It should be easy of execution.

2 It should reduce to a minimum the danger to the life of the patient

3 It should avoid producing degenerative lesions of the ovary

4 It should not modify substantially the nutrition the topography and the functioning power of the different segments of the genital apparatus

5 It should permit of the re establishment of cervico ovarian communication

The first mention of a possible temporary sterilization exclusive of roentgen actino therapy with excessive or ineffective results I have found in the experimental work of Professor Taddei of Florence published in the *Annali di Ginecologia e Ostetricia* 1908 and 1909 In two successive notes this author relates the results of the peritoneal exclusion of the ovary in rabbits This same year 1909 Dr Pana assistant at the surgical clinic of Florence published in the same journal a brief note on the technique of this operation in women Both authors on investigating the integrity of the germinal epithelium after a number of months of inclusion (at least in the rabbits) were able to point out the probability of a subsequent liberation with a possible later conception however neither of them made mention of such an occurrence Neither did they cite clinical cases

The objection which has occurred to me to the Taddei Paná procedure is that the ovular occlusion in women might be accompanied by a hemorrhage of variable quantity but which sometimes might give rise to perceptible exudates even up to peritoneal inundation In these conditions and the absence of clinical documents authorizes the doubt I believe lies the possibility of the formation of small encysted intraligamentous hematomata and is a consequence painful premenstrual disturbances

From the reading of the works to which I have alluded it is given out also that the necessary section of a piece of mesosalpinx provokes even without intraligamentous inclusion endo ovarian circulatory disturbances It is reasonable to think that these disturbances should be reflected in the trophism of the gland provoking very probably modifications in its internal function

It occurs to me starting from a basis analogous to that of Taddei Paná that one could accomplish an intervention on the tube which while occluding it effectively would leave (a) the rest of the tubal canal permeable (b) the tubo ovarian peristalsis intact (c) the approach of these two organs easy salpingostomy having been done in the ampullar region

In a woman whose four former pregnancies had been progressively more difficult there had been present a pyelonephritis which apparently became cured in the intervals between pregnancies but reappeared during each one of them demanding vigilance and very severe treatment In the last two pregnancies the softening of the pelvic articulations compelled the patient to remain almost immovable during the last months In 1916 she presented metrorrhagias due to retroversion of the uterus slightly reducible a suitable pessary could not be tolerated I proposed then a surgical operation and she consented but as she had to go some distance away from home and did not resign herself to the risk of a pregnancy away from her own family physician she consulted me concerning the advisability of taking advantage of the curative operation for the retroversion in order to do a sterilization I explained in detail to her and her husband the consequences and as they were economically so situated that they could face without anxiety the coming of other children they accepted my proposal to do a temporary sterilization

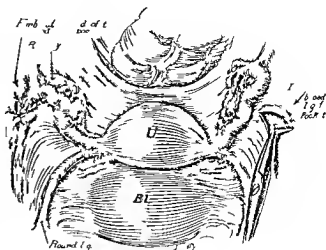
I operated upon the woman according to the technique described below in October 1916 and according to the most recent advices her health is entirely normal Later I operated upon three other patients under the same conditions two of the cases (one on my service at the Maternity Hospital the other in private practice) are too recent upon which to base definite conclusions the third one is making good progress

#### TECHNIQUE

The operation is done with the patient under general anæsthesia—morphine kelene ether The patient is placed in the Trendelenburg position and the Pfannenstiel's incision

used The pelvic and abdominal organs are explored, and if necessary operations on the adnexa and appendix performed After the integrity of the adnexa is established or if the lesions are extremely small (microcysts small adhesions), we proceed holding the broad ligament with two hooked forceps in a way to present amply its anterior surface 10 or 15 millimeters from the lower tubal border and near the ostium we make a 15 or 20 millimeter incision in the anterior layer of the broad ligament we separate the edges of the incision and hollow out in the cellular space which separates the two layers of the ligament a little pocket sufficient to contain the tubal ostium This we fold in and suture for greater security it is fixed to the ligament at a separate point near the tube This organ retains sufficient mobility it is not violently linked and prolonged observation does not show any circulatory disturbance of any sort With this technique one can be certain of being able later to do with ease a salpingostomy and to adjust the opening to the ovary as in the classic salpingo ovariopexy The abdomen is closed by peritoneal and aponeurotic suture intradermic cutaneous suture or with clips

The operation is easy to do and in my judgment a rational procedure which serves the double purpose of a permanent or a temporary sterilization if the occasion for a new pregnancy without risk should reappear There is lacking in my work the experimental work on animals but one of the modes of genital function in the human species men



U uterus Bl bladder

struation is so peculiar to it that the results of the intervention could not be compared Postoperative clinical control and later when occasion presents itself the observation of a woman during a new conception and the inspection and histologic examination of portions of the organs will be the final proof of the efficacy of the operation

The technique which I use is very simple and I believe original I do not pretend to have searched through all the voluminous gynecological literature of the last fifteen years but in examining the books which I have been able to consult I have found no reference to it

Without pretension then to originality I can at least affirm that I have no knowledge that in our gynecological practice the technique which I have described has been thought of or used

## TORSION OF THE SPERMATIC CORD

## REPORT OF TWO CASES AND REVIEW OF THE LITERATURE

BY VINCENT J. O'CONNOR M.D. BOSTON

**T**ORSION of the spermatic cord is reported in 14 instances in the literature. Scudder in 1901 collected 31 cases and added one. Dowden in 1905 discussed 31 cases and Pigby and Howard in 1907 found 40 cases reported. After carefully reviewing the subject I believe that torsion is probably more frequent than would appear from the number of cases reported. The conception of the etiology of this condition and the proper manner of subsequent treatment seems at wide variance among the authors and a resume of the literature is very interesting, if not instructive.

Two clearly defined varieties of torsion of the spermatic cord occur—the acute type and the recurrent type. This distinction was first emphasized by Ferry. The acute type is usually recognized because it becomes progressively more painful and is ultimately operated upon. The recurrent type may very easily go unrecognized, the diagnosis of orchitis or epididymitis being made. During a subsequent attack which does not quiet down so readily the correct diagnosis may be made.

## ETIOLOGY

Torsion may occur at any age. Taylor reports a case present at birth. Dowden at months. House at 48 years and Lever at 60 years. The average for all cases was 13 years and 4 months. The majority of acute cases were seen just before or at the age of puberty. Pearce Gould has described a true venous hypertrophy in the cord at puberty while Davis Colley and Spencer also refer to an increased vascular arrangement in connection with the testis at this period of life. All three of the authors felt that this was an important etiological factor in the occurrence of torsion at this age.

In 70 instances the torsion occurred on the right and in 34 on the left. As is well known the predominance of undescended testis is also on the right.

Fifty-two cases occurred in fully descended testes and 7 in incompletely descended. Torsion occurred in 3 instances in inter-abdominal testes.

Lauenstein believed that torsion occurred because of an abnormally broad and flat cord with what he terms a long mesorchium and which he describes as a floating testicle. Corner makes a like report and describes the condition as a movable testis.

Dowden after operating on 5 cases of recurrent torsion believes that the etiology lies in a faulty development resulting in an inter-mesorchial separation of the cord so that the testis is more horizontally placed and the vessels as a result are drawn away from the vas deferens by the descending globus major.

Pigby and Howard after careful study of nine specimens conclude that in every instance the testicle must be attached to the spermatic cord in some abnormal way, that there is an abnormal attachment of the common mesentery and vessels to the lower pole of the body of the testis and globus minor so that the testis is attached by a narrow stalk instead of a broad band. They also found an elongation of the globus minor and an abnormally capacious condition of the tunica vaginalis. Uffreduzzi states that a testis normal in its attachment can not undergo torsion. Lever and Nicolini made similar observations.

Curling considers the chief factor to be the defective formation or abnormal attachment of the middle strand of the gubernaculum so that as a result there is no fixation of the lower portion of the testis to the scrotum.

Uffreduzzi believes however that the torsion is always brought about by contraction of the cremasteric fibers. His deductions are very clear and the most logical ones advanced and seem to account for the variance of type and degree perfectly. There must be an abnormal attachment of the testis and a certain deficiency in make up of the

gubernaculum associated with a more or less capacious tunica vaginalis. This anatomical variation would not result in torsion the twist itself resulting from repeated contraction of cremasteric muscle bundles strands of which are anomalous. Therefore the degree of torsion that is the number of half turns or full turns the cord undergoes depends indirectly upon the freedom of the testicle to be rotated inside the tunica and directly upon the strength of the muscular contraction. Johnson has made similar observations concerning the contraction of the cremasteric fibers.

Torsion most commonly came on during sleep but instances are given where strain rapid walking coughing crossing the legs etc. was the exciting factor. Gradual and repeated strain was more often noted in the recurrent cases as coitus and defecation.

#### PATHOLOGY

The cord above the torsion contains either dilated or flattened and partially obliterated spermatic veins depending upon the extent of their occlusion in the twist. The spermatic artery is always greatly dilated but usually pervious. If the case is an acute one the surrounding tissue is oedematous if chronic it is adherent and fibrous. In the acute cases the twist occurred from without inward in over two thirds of the cases. Lauenstein referred to this in his cases and quotes Kustner's similar experience in torsion of the ovarian pedicle. In the recurrent cases no rule can be formulated.

The extent of the twist varies from one half turn to two full turns and the site of the twist is always in that free portion of the cord which covered by tunica vaginalis suspends the epididymis and testicle.

Incision into the tunica vaginalis reveals more or less blood stained fluid in the early stages while in the longer standing process it is entirely filled with old blood clot. The remainder of the cord below the twist including the epididymus is greatly swollen and bluish or purplish in color while the spiral intersections produced by the twist are clearly seen. The testis may be only slightly enlarged or it may be double the normal size.

On section the parts show intense engorgement red blue or black depending on the duration. In the longer standing cases there is a destruction of the testis not a necrosis in the ordinary sense of the word but an isæptic death of the gland which in process of time undergoes fibrification and consequent atrophy if left in the scrotum. In the recurrent cases any sharper attack than usual may cause lymph to be deposited in the tunica vaginalis and form adhesions anchoring the testicle. Microscopically there may be seen hæmorrhagic infarction no organ left but merely old blood clot or a diffuse interlobular hæmorrhage.

#### SYMPTOMS

The onset occurs with a varying degree of pain in the lower groin of the affected side. In the cases which do not subside the pain becomes progressively more severe and localizes in the testis and lower cord.

Swelling of the scrotal contents begins immediately and in the majority of cases after 24 to 48 hours ceases to increase. Lexer however reports a case in which the scrotal content gradually enlarged to the size of an infant's head. The swelling involves the cord to the degree of the height of the twist and the scrotum becomes diffusely red, dened and tense or in the case of a testis lying high up in the inguinal canal the superficial structures of the groin assume this appearance. The outline of the testis and epididymis soon becomes obscured and the swelling has the appearance of being drawn upward in the scrotum or inguinal canal due to the shortening produced by the torsion.

Nausea and vomiting frequently follow the onset of pain and in very acute cases a general weakness and malaise is present.

There will be very slight general reaction in the majority of cases and the temperature pulse and leucocyte count will not account for the severity of the local condition.

Stiles reports a case where frequency of urination was the most prominent symptom and Rigby and Howard found difficulty of urination in three cases. Dowden reported oedema of the scrotum as an important sign but others note the redness and swelling as characteristic without oedema.

Edington describes a case in an infant aged 7 months in which there was no pain or tenderness

If no attempt is made to untwist the torsion there is usually a slight subsidence of all pain after a week or ten days but the swelling and a local tenderness persist. In a very small percentage of cases gangrene will eventually set in the usual sequel is a gradual atrophy due to fibrotic changes in the testicle

#### DIAGNOSIS

Epididymitis may be ruled out by the history examination of the urine and rectal palpation of the prostate and seminal vesicles. Orchitis will be differentiated by the character of the swelling the high position of the testis involvement of the cord and absence of history pointing to etiology

Hydrocele fibroma of the cord acute ruptured varicocele or lymphadenitis of the horizontal chain of glands can be readily ruled out. Strangulated hernia or incarcerated omental hernia are frequently diagnosed or are ruled out only with great difficulty. If the testis is absent from the scrotum the former conditions can be ruled out with greater ease but the differentiation from hernia is more difficult. A coincident Richter's hernia can hardly ever be entirely excluded as a possibility

The redness of the scrotum the elevation of the testis and the limitation of swelling to the lower inguinal canal are all important. Carefully studied cases may be doubtful until operation especially in the acute cases occurring where the testis is situated high up in the inguinal canal. Whipple and Nash report a case where the vomiting became stercoraceous and a definite diagnosis of strangulated hernia has been made in over half of the cases where the vomiting was present. Cupler reports a case of strangulated right interabdominal testis with symptoms simulating appendicitis

Stanton and Shaw and Colding have reported cases of inflamed appendices adherent to the testis in the tunica vaginalis in which the pre-operative diagnosis was in doubt but in these rarer conditions the swelling is practically never confused with that of torsion

#### PROGNOSIS

In recurring torsion the attacks will continue and will probably result in a varying degree of atrophy accompanied by neuralgic pain unless an orchidopexy is performed. Some few cases have had no recurrence after the first manipulation to untwist the cord but these were always in cases seen and recognized in the early part of the first attack

In the acute cases with marked symptoms there is usually no relief for a long period of time except by manipulation or operative interference. So far as recorded torsion of the spermatic cord has never proved fatal

#### TREATMENT

1. *Detorsion* has been successful in a few cases of torsion in fully descended testes when seen very shortly after the onset of symptoms. It should therefore always be attempted in cases seen early but only in those where the testis is outside the external abdominal ring. It is obviously impossible where the strangulation has existed long enough for engorgement of the testis to occur or for much fluid to accumulate in the tunica vaginalis

Detorsion is accomplished by grasping the testicle between the thumb and second finger and slowly rotating on the vertical axis first trying from within outward as the torsion most often found has occurred in a counter-clockwise direction. No force should be used and torsion should be continued until relief is felt or pain and resistance become so severe that it is obviously the wrong direction

In one instance a patient with recurrent torsion was taught to perform detorsion successfully upon himself for many years. However if after a successful detorsion has been accomplished the condition recurs an orchidopexy is immediately indicated

Perry reports a case recurrent every two months for two years and Dowden had two cases recurring frequently for ten years. During this time atrophy of the testis occurs and operation is practically always resorted to eventually before a lasting relief is obtained

It is always unwise to attempt detorsion

in an undescended testis and because of the impossibility of ruling out coincident hernia operative interference is always immediately indicated in these cases.

*Orchiectomy* should be performed in all cases where it is deemed advisable to save the testis and where there is no anatomical condition present that will interfere with the success of the procedure.

The usual transposition can be done on undescended testes with satisfactory results. In fully descended testes any operation that performs and accomplishes a fixation preventing recurrence will achieve a cure. A simple eversion and suture of the tunica vaginalis is usually sufficient.

3. *Orchidectomy*. In an adult where transposition of the undescended testis cannot be satisfactorily accomplished or in any case where necrosis gangrene or persistent circulatory obstruction is present removal of the testis and the involved portion of the cord is indicated.

CASE 1: Patient E W a riveter by occupation and aged 31 years presented himself at the Peter Bent Brigham Hospital giving the following history.

He had gone to bed two weeks before feeling perfectly well but on waking in the morning had a severe dull pain in the right testicle. He noted that the scrotum was slightly swollen and very tender to palpation. Otherwise he felt well. He remained at home during the day and called his family physician who told him he had inflammation of the testicle and advised him to remain in bed with the scrotum elevated. Cold cloths were applied constantly but the swelling and pain gradually increased during the day and the scrotum and right groin became hot and reddened. Morphine was required to ease the pain at night. The pain continued to be very severe for three days and then gradually became less disturbing but the swelling persisted although it did not increase after the second day. The skin remained reddened and the right scrotum and groin were still very tender to palpation when the patient presented himself for examination. There had been slight anorexia but no nausea or vomiting. The bowel had moved daily as usual and urination had been normal. The patient came to the hospital because he felt that he was not improving. He claimed to have lost 10 pounds since the onset of the trouble.

Admission temperature pulse rate and respiration were normal. Blood examination showed 90 per cent hemoglobin 14 000 leucocytes 4 250 000 erythrocytes. Urinalysis was normal.

The family history was of no importance. He

had had the usual diseases of childhood no previous accidents or operations and an attack of gonorrheal urethritis ten years before without subsequent symptomatic complications. He denied syphilis or chancroidal infection. No cardio-respiratory gastro-intestinal or neuromuscular complaints.

The patient remarked that the right testicle had always been situated high up in the scrotum but that since the onset of his trouble it seemed to have been drawn up even more than formerly.

Physical examination showed a well developed and nourished man normal in every respect except for his local condition in the right groin and testicle. There was no pain rigidity or tenderness over any part of the abdomen except in this region and there was no visible peristalsis noted. The skin over the right inguinal canal and right testicle was of a dark reddish blue color and only slightly tender to palpation. Over the external inguinal ring it was adherent to the underlying structure. There was no edema of the scrotum. In the right inguinal region and extending into the scrotum there was a hard mass connected with the testicle which was held high up as though incompletely descended. The mass could be traced up the inguinal canal to the internal inguinal ring and so filled the inguinal ring that the outline of the latter could not be palpated. It did not transmit light was non-reducible and was flat on percussion. The left external inguinal ring testicle and cord were normal. Reflexes were normal. Blood Wassermann was negative. The diagnosis of torsion of the right spermatic cord was made.

At operation the spermatic cord above the external ring was normal except that the spermatic artery and veins were double their normal size. No hernial sac was present. At the external inguinal ring the structures surrounding the cord were fibrous and adherent to it. The cord was strangulated by a rotation upon itself in a clockwise direction. The extent of the rotation was one half turn (180 degrees). No gross abnormality of the cord or its attachment to the body of the testis was discovered except that three prominent strands of cremasteric muscle were reflected low down their origin being just above the site of the torsion. After freeing the dense fibrous tissue about the cord the normal position of the cord and testicle could be restored by rotating the testicle one half turn in a median direction. Incision into the tunica showed no fluid and no normal testicular tissue the cavity being filled completely with old blood clot. There was no bleeding upon incising any of the structures below the point of strangulation.

On section the contents of the tunica appeared as dark red blood in the form of dark red clots the accumulation being greater in the upper pole of the organ. The epididymis was swollen double its normal size with considerable dark red blood surrounding it and the normal tissue almost entirely replaced by clotted blood. The spermatic artery





URETERAL OCCLUSION ITS RELATION TO RENAL LESIONS<sup>1</sup>

By HENRY G. BUGBEE, M.D., IACVS, NEW YORK  
 U. I. g. t. St. L. k. W. m. I. L. H. p. t. l.

URETERAL occlusion is of frequent occurrence is partial or complete is sudden or slow in taking place gives rise to many and varied symptoms is often unrecognized even for years and should be eliminated as soon as possible—not only for the relief of the symptoms it causes but for the welfare of the kidneys.

The maintenance of a healthy kidney depends almost entirely upon the amount of work thrown upon it plus the maintenance of free drainage. The first factor is in direct relation to the general physical condition of the patient and the latter to free exit from the kidney tubules to the bladder and some times from the bladder.

Too much stress cannot be laid upon the factor of the supply of toxins and bacteria to the kidney and in this relation the kidney function should be regarded as a terminal process dependent upon the health or pathology, *local and collective* of all the parts of the body and it should not be studied or treated until a thorough knowledge of the patient's condition particularly as to the existence of focal infections has been obtained by all the methods at hand.

When the question of supply to the kidney has been ascertained a study of the elimination is in order. The first and to my mind the most important element in this connection is free drainage. However great the load that is thrown upon the kidneys—primarily from the circulation secondarily from the lymphatics and possibly thirdly by direct extension from surrounding viscera—the kidneys will stand up remarkably under the burden if free drainage is maintained.

Sudden complete obstruction is usually recognized yet while such cases require much study and surgical judgment for their proper management it is the cases of long continued slowly progressing or intermittent occlusion with their consequent kidney changes that require special study first as to the diagnosis of the occlusion second as to the proper

relief of the obstruction third as to the actual amount of kidney change that has taken place and lastly as to the proper course to pursue in future kidney management.

While the ureters are apparently well protected by being deeply placed in the abdomen—shielded posteriorly by the muscles of the back and the bony pelvis anteriorly by the peritoneum and its contents—they are particularly liable to pressure from without since they lie upon a firm bed favoring compression from in front. This is particularly true as they cross the iliac vessels at the brim of the pelvis the ureters being angulated at the same time. There is also a tendency to angulation at the ureteropelvic junction and again as the ureters enter the bladder wall.

The ureter is loosely attached in its course but is fixed to a heavy organ (the kidney) above and to the bladder below. The kidney is more or less mobile and it is easy to see how even slight abnormal mobility may allow a prolapse of the entire ureter or a kinking or a buckling to take place. Lying in direct contact with the peritoneum throughout most of its course in its close affinity with the perirenal tissues and with the appendix on the right side intimately connected with the uterus and adnexa in the female and with the prostate and seminal vesicles in the male and incorporated in the bladder wall for the terminal 3 centimeters of its course the secondary involvement incident to lesions of these structures is apparent. To this must be added the fact that the ureter is bathed internally with urine often containing large numbers of bacteria and irritating elements.

The blood and lymphatic supply of the ureters bring them into intimate relation with surrounding organs and the nerve supply from the spermatic renal and hypogastric plexus of the sympathetic system explains the complexity of symptoms and the difficulty in the differentiation of ureteral lesions subjectively.

In taking up the causes of ureteral occlusion I will mention several conditions which are vesical rather than ureteral but which should be considered in this connection. The first is the presence of a large vesical calculus filling the bladder and causing obstruction at the ureteral orifice and the second tumors of the bladder wall in the region of the ureteral orifice. The writer operated upon a case of the former in 1910. The patient entered the hospital in a uremic state. A calculus was found completely filling the bladder cavity. The removal of the calculus was followed by urinary suppression.

Numerous cases of papilloma of the ureteral margin have been observed. In one instance partial obstruction of the ureter with kidney dilatation was observed in another complete occlusion resulted from congestion (a local reaction) when the papilloma was treated with the high frequency spark. Renal colic ensued at once and was relieved in each instance by an indwelling ureteral catheter. A recent case coming under observation presented each ureter occluded by multiple tumors (hypernephromatosis).

A condition encountered in a series of cases is ureteral occlusion with severe colic due to acute congestion of the prostate. The sudden enlargement of the prostate in these cases which is most pronounced intravesically causes a pulling and angulation of the vesical portion of the ureter and back pressure on the renal pelvis. The ureteral orifice is seen opening on top of the prostatic enlargement. The patients observed were all young men and a diagnosis of impacted ureteral calculus had previously been made in each case. Many of them were sent into the hospital as acute surgical condition. In none could the ureter be catheterized. In several of the cases there was found a distended seminal vesicle which undoubtedly contributed to the occlusion. All were relieved by local treatment.

A cystic condition of the ureter at its orifice has been noted. This is often difficult to differentiate from a prolapse of the ureter into the bladder. Both conditions have been encountered causing back pressure upon the kidney. The cystic condition is relieved by

incisions the manipulation being carried out through the cystoscope. Prolapse of the lower ureter into the bladder is usually part of a prolapse of the entire ureter and kidney most often in cases of general varicoposis.

A small round ureteral orifice is occasionally seen and I have always found in these cases polycystic kidneys above. It is possible that this small orifice exists in the advance of the cystic dilatation of the kidneys. Stricture of the ureteral orifice following tuberculous ulceration, the long continued irritation of a calculus lodged at this point or manipulation (especially cauterization) is not uncommon. The lesion progresses so slowly that complete destruction of the kidney from back pressure and possibly added infection may result before a diagnosis is made. I have been able to divide or dilate strictures located at this point by cystoscopic operative measures.

Spasm of the ureteral wall I have found frequently and with few exceptions always in the female. It is noted as soon as the catheter enters the ureteral orifice. The ureter grips the catheter and the harder one pulls the catheter the tighter it is gripped by the ureteral wall. If the catheter is rotated in the fingers the ureter coils up with it and attempts to withdraw the catheter pull the lower ureter into the bladder. The importance of this condition has not been appreciated. It is I believe a reflex phenomenon often diagnosed as stricture. I have found it in highly nervous women often in ureteral prolapse also in infections of the urinary tract and in the presence of impacted ureteral calculus. When only the spasm is present it may be the cause of fleeting attacks of kidney pain which cannot otherwise be accounted for. By withdrawing the catheter and inserting another it will often pass without difficulty. The action is quite similar to the spasm often encountered in passing urethral instrument.

I have observed one case of valve formation at the ureteral orifice resulting in congenital hydronephrosis.

Occlusion of the vesical and pelvic ureter is most often due to impacted calculus. If a calculus leaves the kidney pelvis it may be

come impacted at the ureteropelvic junction at the pelvic brim possibly between these points or it may pass these limits and lodge in the pelvic ureter probably at the point where the ureter enters the bladder wall. Few calculi pass through the lower 3 centimeters of the ureter without becoming at least temporarily impacted. Some lodge here intermittently interfering with kidney drainage others remain slowly increasing in size causing local ureteritis back pressure upon the kidney with slow renal destruction and usually renal infection. The number of cases presenting renal tuberculosis and even renal tumors coincident with impacted ureteral calculi gives evidence of the importance of occlusion in predisposing to kidney lesions and the necessity for the removal of the occlusion as soon as the diagnosis is made.

That the vast majority of these calculi will be passed following intra ureteral manipulation will be seen by the following figures: Of 12 calculi lodged below the pelvic brim—seen by the writer since 1910—81 have been passed following manipulation and but 11 have required open operation (ureterotomy). All of these 11 were large calculi and had histories of long impaction. Three cases now under observation may require open operation. It is not always a question of the size of the calculus more depends upon the length of time since the first colic the number of colics the presence of ureteritis dilatation of the ureter and kidney pelvis above and also the patency of the ureter below. If the ureter is dilated above the calculus and a ureterotomy is contemplated an examination should be made just before operating as a calculus impacted low down in the ureter often moves backward. This is particularly true after passing ureteral catheters. In three cases this has occurred in the writer's experience at operation it was found that the calculus had passed back into the kidney pelvis. Kretschmer reports similar experiences.

Ureteral kinks in the pelvic portion of the ureter may cause obstruction but these are comparatively rare. I have seen few cases where I felt that this was the cause of the obstruction when the occlusion was in the pelvic ureter. Strictures secondary to cal-

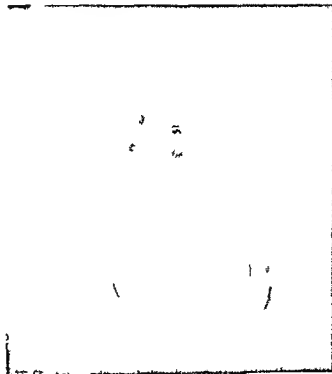


FIGURE 1. Kink in the Ureter. Nephrograph.

culus tuberculosis adhesions extension of surrounding inflammation especially from a diseased appendix or pelvic disease have been frequently encountered. Other strictures such as those described by Hunner have not often been found by the writer. There are wide variations in the caliber of ureters the same as are found in the size of the urethra and this fact must be borne in mind before a diagnosis of stricture is made.

A complete occlusion of both ureters was found in one case resulting from a wide cicatrix following cauterization of the uterine cervix with a Percy cautery. There had been complete retention of urine for 11 days. Each ureter above the point of occlusion which was close to the bladder wall was dilated to the size of a thumb. Each ureter was cut off and implanted into the bladder fundus. The kidneys began to functionate at once and the patient went on to a complete recovery.

Not infrequently the lower ureter is injured during pelvic operations and either ligated with the uterine artery or a ureterovaginal fistula results. I have seen one case where each ureter had been twice ligated and seven other cases in which one ureter was ligated





FIG. 3. The sharp ureteral kink—pyelonephritis

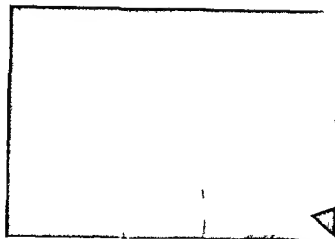


FIG. 4. Kidney with pyelonephritis

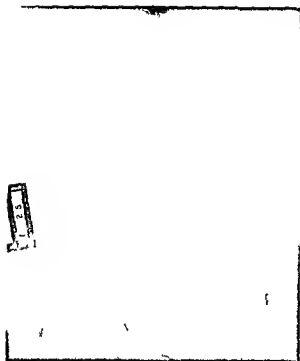
upon the ureter during pregnancy in many cases accentuating an occlusion present before conception. The rapidity with which cases of pyelonephritis of pregnancy improve after establishing renal drainage with ureteral catheters again shows how important a role occlusion plays in renal infection.

In congenital anomalies of the kidney and ureter renal lesions are common not only because of the poor blood supply and pressure upon the malplaced organs but because of the disturbed drainage in these cases. A kidney once enlarged by its own increasing weight as well as by pressing upon the ureter as it enlarges increases the ureteral occlusion and thus hastens renal change.

Calculi in the upper ureter are found much less frequently than in the lower portion. They are often of good size and usually require open operation. One calculus impacted at the ureteropelvic junction was dislodged after manipulation which was carried out for diagnostic purposes. The operation was postponed and on two other occasions when the patient presented himself for operation there was a repetition of the colic with further descent of the calculus until with the

last attack he passed the stone one of large size. While pressure upon the upper ureter structure (congenital and acquired) displacement of the kidney by tumors of other abdominal viscera, traumatic injury and plugging occur, still such causes of occlusion are less common here than in the lower ureter.

In reality the pelvis and calyces of the kidney should be considered as forming a dilated upper extremity of the ureter their fibrous muscular and mucous coats being continuous. There is the same relationship between the pelvis and ureter that exists between the bladder and urethra. We are well aware of the fact that whether an obstruction to the outflow of urine from the bladder be at the vesical neck or in the urethra certain changes ensue. The bladder at first increases its effort and this leads temporarily to greater muscular strength also to congestion particularly at the point of obstruction. Later as the obstruction is maintained the bladder function becomes weaker and urine collects in increasing quantity behind the point of occlusion. So long as the urine remains free of infection and the obstruction increases slowly this process may continue for an almost indefinite period. Sooner or later however the usual course is for an infection to take place from the urinary stream or from instrumentation the latter usually accompanied by traumatism and while the continued back pressure has led to a certain degree of permanent change to

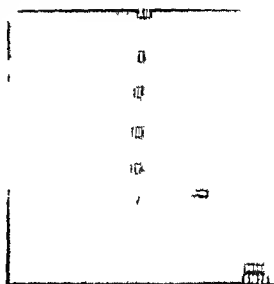


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the bladder with the advent of infection rapidly increase the change.

Chronic changes are just as inevitable when there is an occlusion of the ureter as the bladder change in urethral obstruction rather more so for the renal pelvis has not anatomically or physiologically the same power of compensation in meeting emergencies as has the bladder. Experimental and clinical investigation shows that sudden complete occlusion of the ureter may cause immediate cessation of function in a kidney or a hydronephrosis may result from a continuation of renal function without exit for its secretion. Partial incomplete or recurring ureteral obstruction will cause slow dilatation of the ureter above the point of occlusion dilatation of the renal pelvis and valves back pressure upon the urinary tubules congestion of the kidney parenchyma with varying degree of inhibition of function and invariably unless relieved lead to infection from the bacteria constantly supplied to it the last step being actual kidney destruction.

The observation lead me to suggest that what might be termed the stage of preparation in



1 5 1 1 1 d d d 1 1 1 1

all kidney operation. Much has been written regarding the preparation of the patient for prostatectomy and the importance of this preparation as well as operation in two stages is well recognized. Oftentimes this preparation is more important in prostatectomy for both kidneys are actually impaired yet the more carefully we study our kidney lesions the more often we find the apparently sound kidney suffering not only from the double work thrown upon it but to more than double work due to absorption from the diseased organ.

In continually reviewing the history of urological care in cystoscopic studies in glancing over roentgenogram in operations I am more and more impressed with the role of kidney drainage in the causation of renal pathology. I am also quite impressed with the remarkable reparative power in the kidney as to the rapidity and completeness with which the kidney regains its function when drainage is reestablished particularly when (in addition as should always be the case) the amount of work thrown upon the kidney is reduced.

The points are well illustrated by the following typical case.

A woman 34 years of age a severe neurotic  
 Shiga history of total atony of the bladder  
 for 15 years. The patient had been treated for  
 15 years with various methods of treatment but  
 with no result.

perienced a sharp renal colic. Three months before I saw her a calculus 1 centimeter by 1.5 centimeters had been removed from the right ureter and a urinary fistula had persisted. By intra ureteral manipulation I dislodged a calculus in the ureter below the fistulous opening. Kidney drainage with a ureteral catheter resulted in a closure of the fistula. At this time both kidneys presented a colon bacillus infection, the function of both was diminished, the right being one third that of the left. The right kidney was large and prolapsed. Further manipulation in the ureter and renal lavage with periods of continuous kidney drainage with ureteral catheter resulted in the passage of twelve calculi (in all) the last being 3.5 centimeters by 1.5 centimeters in size. The rapid improvement of the general and local urinary condition both during and after this period of treatment until the passage of the last calculus in 1917, a period of a little over 2 years was most gratifying and today, with abdominal support and moderate attention to diet and bowel, she has two kidneys free of infection with only a slightly diminished functional activity of the right kidney.

From the foregoing it will be seen that the ureters, the normal conduits of the kidneys, are small tubes which from their anatomical position and conformation are particularly liable to occlusion. Such occlusion may be due to many causes and its occurrence is an important factor in the promoting of renal lesions.

The diagnosis of ureteral occlusion should be made early and steps taken for its relief that the symptoms may be eliminated and kidney destruction prevented.

The relief of ureteral occlusion requires a most careful study of the patient as well as of



Fig. 7. Bilateral ureteral calculi. Calculus in left ureter passed following intra ureteral manipulation.

the urinary organs. It may be termed the first step in kidney operations.

With the patency of the ureter reestablished, free drainage of the kidney restored (possibly with the aid of indwelling ureteral catheters) and lavage of the renal pelvis and with a lightening of the load thrown upon the kidneys, the regeneration of kidney function is often remarkable. A kidney operation may be averted or a conservative operation supplant a nephrectomy in establishing a cure in a much improved patient.



# CONGENITAL DEPRESSIONS SINUSES AND CYSTS OCCURRING IN THE SACROCOCCYGEAL REGION

B. R. W. McNALLY, M.D., Chicago

**I**MPUIOSL in this brief paper to discuss the depressions, sinuses and cysts which are of congenital origin and are found in the median line of the back over the coccyx or the lower portion of the sacrum. I shall confine my discussion of the cysts to those of simple epithelial lining (simple dermoid).

Wetzel classifies these conditions according to the degree of the anomaly into: (1) fovea sacrocoecygea; (2) fistula sacrocoecygea; (3) epidermoid sacrocoecygeal cysts. He holds that they are all only varying degrees of the same type of anomaly.

Depres and Lannelongue state that the anomalies are to be found in some degree in one third of all newborn infants but that by adult life they are found in only 5 per cent of people examined. Since my attention has been called to these conditions I have been impressed by their frequent occurrence with out their ever having been noticed by the patient.

The large majority of cases are found in males. In discussing postnatal dimples Lynch states that all of his 51 cases were male. Clifton and Archibald had only 2 females in their 51 reported case. I have had only one female in my operative case although I have found the condition present in many females in the course of examination.

Most of these cases escape notice until adult life when due either to infection or rapid increase in size they become troublesome.

The fovea sacrocoecygea or simple depression as a rule give rise to very little trouble.

The sacrocoecygeal fistula may be single or multiple. They may be simple epithelium-lined canal extending from the skin surface to a variable depth in the loose tissue over the sacrum or coccyx. Where infection is present or has been present the epithelial lining is replaced by granulation and connective tissue. It is not uncommon to find these fistulas filled with loose hairs which Hodges maintains are rubbed off of the body and crowded into

the fistulous openings. Some of the fistulas have dilated cysts at their depths which contain loose hair, cholesterol crystals and the products of skin gland. The presence of hair in these fistulas and cysts has always attracted considerable attention as well as speculation as to the origin of the hair. These hair-filled fistulas and cysts are termed pilonidal sinuses and pilonidal cysts respectively.

It is apparent that the fistula may be primary or secondary. The secondary fistulas follow suppuration and discharge of the content of a cyst. The discharge may find its way through a preformed epithelial tract or it may burrow for some distance through the soft parts before coming to the surface. I had one case in which there were three widely separated fistulous openings. One opening occurred in the mid line about 1 centimeter from the anus, the other two were about 2 inches above the first and about 1 inch on either side of the median line. The three fistulas originated from an infected cyst near the tip of the coccyx. The two upper fistulas were the result of the pus burrowing in the soft tissue while the lower fistula followed in the tract of a congenital epidermal invagination.

The dermoid cysts of the sacrocoecygeal region vary in size and are generally situated immediately beneath the skin but they are sometimes found deeper near the tip of the coccyx. Wetzel reports one case where the cyst was found in the spinal canal. As a rule the cysts are adherent to the skin or connected to it by the apex of an invagination of epidermis. In dissecting out these cysts it is customary to find them connected to the spinal column by fibrous bands. The wall of the cyst varies in thickness depending upon the amount of connective tissue present. Some of the cysts are lined by stratified squamous epithelium and show hair follicles and rudiments of sweat and sebaceous gland.

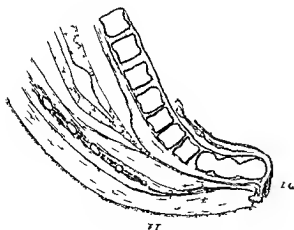


Fig 1 C M Conus medullaris V S vertebra sacralis S sympathetic A S M arteria sacralis media L C ligamentum caudale V C vestiges coccygens P peneosteum F T filum terminale (After Unger and Burgsch)

Czyewicz describes a case in a man 23 years of age in which the cyst contained a bunch of hair but there were no hair follicles in the remaining epithelium lining the cyst. In the cases operated upon by me I have never been able to demonstrate hair follicles in the epithelial linings of the cysts although several showed bunches of hair.

Many theories have been advanced to explain these fistulae and cysts.

Mason Warren thinks they arise from the hair growing in an abnormal direction from the follicles the irritation caused by the hair causing inflammation which results in fistulae or cysts.

Lawson Tait attributes them to rudimentary tail formation in man.

Kuhn believes they are the remains of a hydrocrachis beginning during intra uterine life.

Iannelongue believes them to be due to a persistence of a foetal connection which exists between the external skin and the lining of the medullary canal. The persistence of this connection causes the fistulae and when the fistulae are later constricted cysts arise. He explains the characteristic localization of the lesions by the fact that the mesodermal masses which produce the separation between the medullary canal and the external skin are less well developed in the coccygeal region than elsewhere. In this way they have less force to loosen this connection during the developmental period. This theory is accepted by Evrard, Duverrier and Couroud. Wendelstadt and Wette have a similar theory except they think the site of the fistulae and cysts is due not to insufficient development of the mesodermal masses but to delayed closure of the medullary canal.

Masse assumes that they owe their origin to the persistence of the medullary tube.

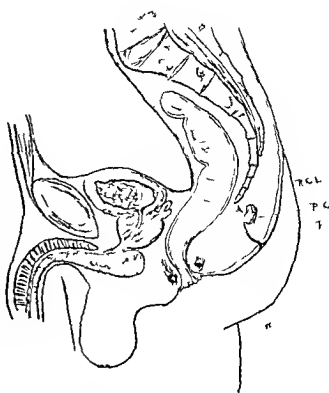


Fig 2 F I fistulous tract P C pilonidal cyst A L C remnant of caudal ligament

Madelung believes them to result from an abnormal development of the ligamentum caudale.

Mallory made microtome sections through the sacrum and coccyx of various dead embryos. He concluded from his findings that these fistulae and cysts are due to an incomplete obliteration of a foetal canal and reasoned that since they all extend upward and posteriorly to the coccyx the medullary canal seemed the most likely origin.

The theory which is usually accepted at present is the one formulated by Tourneux and Herrmann based upon their interesting work in embryology. The development of the central nervous system by infolding of the primary ectoderm needs no explanation except to explain certain departures from the uniform development which are peculiar to the caudal end of the spinal cord. The description of these changes I have taken from Keibel and Mall's book on human embryology.

If one examines a sagittal series through an embryo 11 centimeters long (as shown in Figure 3) it can be seen that the extreme tip of the cord lying in the tail anlage has been closed off to form a simple epithelial sac. The lumen of the cord above this point becomes obliterated and there results a slender solid strand of nervous tissue which we know as the

**flum terminale** The epithelial sac becomes the vestige medullaire coccygien of Tournour and Herrmann the development of which is described by Tournour as follows At the beginning of the third month the neural tube still extends to the extreme end of the vertebral column into the tail bud and its slightly enlarged tip is closely united to the deep layers of the skin Toward the end of the third month the spinal column develops faster than the soft parts draw along the periphery of the neural tube that is adherent to it and whose extreme tip remains attached to the skin As a result of this unequal growth the terminal or coccygeal portion of the neural tube becomes bent in the form of a loop the more deeply situated limb of which is attached to the posterior surface of the coccyx (segment coccygien direct) and the other more superficial limb extends obliquely from the usual normal position to the most dorsal and cranial segment of the coccyx (indirect) During the course of the fourth month the more deeply situated limb the segment coccygien direct atrophies and disappears while the more superficial one the segment rudimentary continues to develop into the fifth month and gives origin to the cell cord cells which constitute the caudal nerves either directly or pavement epithelium these are the vestiges medullaires coccygien or paracoccygens These structures from the sixth month on suffer a progressive atrophy but it is possible to follow their traces until the time of birth

The simple depressions and the fistulae are explained by the more rapid growth of the soft parts causing traction of the ligamentum caudale upon the vestiges coccygien which is intimately attached to the deep layers of the skin

There are two types of cysts Cysts of the first type are due to dilatation of the epithelial sacs which constitute the vestiges medullaires coccygiens Cysts of the second type may occur as a result of dilatation of the deep part of a fistula or to occlusion of a fistulous tract near its outlet It is possible that they may be formed by the skin anlage being entirely constricted off from the surface and existing in the soft tissue This difference in origin of the two types of cysts may explain the variations which are to be found in the microscopic examination of the cyst walls In cysts of the first type nerve cells are sometimes found in the cyst wall Various mixed tumors are said also to originate from these vestiges coccygiens but I have purposely omitted any discussion of these or the der-

moids supposed to originate from the hind gut or neurontenic canal

The treatment of these cases herein described follows the routine technique for similar conditions elsewhere

The simple depressions as a rule give no indications for intervention

The fistulae are carefully dissected out and immediate closure made if one is reasonably assured that all the fistulous tract has been removed and no infection is present If infection is present it is best to allow tracts to granulate after dissection I do this in nearly all cases I have found it advantageous to make a circular incision around the mouth of the fistula and suture it to prevent escape of contents during dissection Where multiple fistulae exist the various ramifications may be shown by injecting Beck's paste and taking a roentgenogram Lynch recommends the use of methylene blue in peroxide for tracing anal fistulae and I have employed his method very successfully in these fistulae I have also injected iodine into the fistulae before dissection but do not recommend it

Some of the cysts are the seat of acute inflammation changes and must be opened and drained later following with complete dissection I had one case come into clinic which had been operated upon four times Two fistulae were present at the time of examination Under general anesthesia a careful dissection revealed a small cyst containing a ball of hair The cyst wall was closely attached to the coccyx

Many of these occluded fistulae and cysts are diagnosed as furuncles and incised and drained leaving a chronic discharging sinus Care must be exercised in not confusing these fistulae with those of anal tuberculous or syphilitic origin Lynch reports a case in which a degenerating syphilitic focus discharged through a sacrococcygeal fistula and was operated upon several times before its nature was discovered

In view of the fact that nearly all of my cases had been previously operated upon I strongly recommend a thorough examination of all fistulae and cysts occurring in this region If any trace of epithelial tract is left in these cases a cure cannot be expected

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# DEPARTMENT OF TECHNIQUE

## SECONDARY WOUND CLOSURE

### REPORT OF 961 CASES

B. ADDISON C. BRUNZLER M.D. CHA. TTE NO TH CARLEN  
L. M. L. C. L. M. C. (b. f. l.) gals. rce B. e. Hoq. IN. 6 AEF

DURING my service as Chief Surgeon Base Hospital No. 6 A E F France March 10 1918 to January 16 1919 being in April 8 1918 and ending December 17 1918 961 secondary wound closures were done most of them by surgeons who were associated on this service.

The majority of the closures were made on the fourth to sixth day after the reception of the wound and the primary excision and before the twelfth day that is before the thin bluish attenuated epithelial edge had formed and the skin had become fixed in its retraction.

The term primary wound closure delayed primary wound closure and secondary wound closure are familiar to all. The terms have been employed however arbitrarily it seems to me to indicate a period of time between the reception of the wound by the patient and the time of closure. Even on this basis it is well understood that a wound which is excised and sutured not longer than 8 hours after receipt may heal *per primam* under surgically aseptic condition and thus be regarded as a primary wound closure. If the wound is left open for 2, 3 or 4 days whether or not it is treated with Dakin's solution it may remain surgically sterile which is determined by quantitative or qualitative bacteriological examinations and then be closed and remain closed. This is known as delayed primary closure. The decision as to whether these wounds be closed or not is based entirely on the first instance on the thoroughness of the excision and chance and in the second instance on the thoroughness of the excision plus or minus the use of Dakin's solution with a bacteriological check.

Secondary wound closure on the other hand is preferably done when after primary excision there has developed from the surface of the wound inward a layer of loose granulation tissue and underlying stratum of connective tissue and a

cellular barrier of leucocytes in other words when the wound has developed not only new tissue formation but also considerable local resistance coupled likely with a certain amount of general immunity against the bacteria invading the wound especially the staphylococci. This condition of local resistance at least is well known to surgeons who have operated on abdomens which have been repeatedly soiled at previous operations especially for closure of intestinal fistule.

With this idea in mind we at first closed a few wounds without bacteriological control and without the removal of the more loosely textured surface granulation tissue with Dakin's solution. This we did simply by painting the surrounding skin and granulation tissue with iodine disinfecting the granulation tissue and thin layer of connective tissue from the underlying structures *en masse* and closing the wound. Most of our wounds healed even in this way but a few of them became quite red and swollen the patient became toxic and the wound broke down. In these wounds we almost invariably found the streptococcus. We then disregarded entirely the quantitative bacteriological examination of wounds as prescribed by Alexis Carrel and depended on qualitative culture to eliminate the streptococcus in particular the gas bacillus and the tetanus bacillus. All wounds not showing streptococcus and the gas bacillus and which had within 10 days sufficient antitetanic serum were closed immediately by our technique of secondary wound closure. This technique was designed to remove mechanically the bulk of all bacteria. When the streptococcus was found present the wound was treated with Dakin's solution by the Carrel method until the streptococcus appeared no longer in culture. When the gas bacillus was found the wound was similarly treated and Bull and Pritchett's gas bacillus antitoxin was given. The wound when

very moist and covered with necrotic tissue was chemically scoured with Dakin's solution.

Smears were made on small sterile cotton swabs placed in a culture tube and sent to the laboratory. These swabs were shaken in serum broth incubated for 24 hours, smeared on a slide and stained by Gram. The streptococcus and gas bacillus were detected microscopically by the fact that they retained Gram stain by their manner of growth and their morphology. The laboratory reported on as many as 168 such cultures in 48 hours.

Our technique of secondary wound closure was carried out as follows. The surrounding skin was cleaned with ether and painted with iodine and the whole granulating surface was covered with gauze soaked with iodine. A clear cut incision was made just outside the epithelial edge through the skin and the skin undermined. The granulating area was then undermined and dissected away *en masse* thus removing mechanically the bulk of all bacteria. The granulation tissue was not scraped off but was dissected off with a layer of the new formed connective tissue down to the fresh bleeding underlying structures. The raw area was again painted with iodine and all bleeding carefully stopped. Fascial planes were closed all necessary repair to tendons, nerves and vessels was done including curettement of bone and the skin edges were closed without tension.

In this way we closed in a period of 8 months 961 wounds with but one death and that from tetanus in a case having received three injections of antitetanic serum the last less than 10 days before the wound closure.

Our functional results were as follows:

|                                    | N   | m | b | F  | C | t |
|------------------------------------|-----|---|---|----|---|---|
| Successful closures                | 894 |   |   | 93 |   |   |
| Partial successful closures        | 35  |   |   | 4  |   |   |
| Failures                           | 29  |   |   | 3  |   |   |
| Closures over fractures            | 3   |   |   |    |   |   |
| Successful closures over fractures | 18  |   |   | 9  |   |   |
| Failures over fractures            | 5   |   |   | 21 |   |   |
| Cases returned to duty             | 65  |   |   |    |   |   |
| Deaths                             | 1   |   |   | —  |   |   |

The distribution of the wounds over the body was as follows:

|                                 |    |
|---------------------------------|----|
| Scalp                           | 8  |
| Face                            | 1  |
| Neck                            | 13 |
| Trunk—chest abdomen back flanks | 10 |
| Arm—shoulder arm f rearm        | 8  |
| Hand                            | 25 |

|                   |     |
|-------------------|-----|
| Leg—buttock thigh | 56  |
| Foot              | 5   |
| Amputation stump  | 4   |
|                   | 961 |

Our method of secondary wound closure enabled us to close a large number of wounds at the most opportune time between the eighth and twelfth days and immediately after the receipt of the wounded.

The majority of the wounded thus operated upon moved back to duty within 6 weeks with good functional results. A larger number than that reported would likely have reached duty had they not been transferred to other centers and had we had the opportunity of developing them in our convalescent companies or on our training farms. Those not returning to duty were prevented more by severe injuries to deep structures than by extensive scarring even in tremendous wounds. The time chosen for closure and our technique of closure favored a supple wound.

Those cases of open wound with fracture were selected cases showing little or no comminution and no small fragments. Our success with these cases however hardly justified a continuance.

The secondary closures of amputation stumps were successful save for an additional sacrifice of bone. Secondary suture was abandoned for traction and spontaneous closure in most cases.

The loss of life or limb was negligible in our series.

The distribution of wounds closed, their size, contour, depth, etc., will suggest as was actually the case, the possibility of multiple and varied skin plasties to cover the raw surface.

A great many wounds of the scalp were small gutter wounds and were left to heal by granulation.

The most difficult wounds to close were those of the foot, the hand, and the wounds everywhere over the body where a circular area of skin had been cut away at the time of the primary excision.

Eliminating the streptococcus, gas bacillus, and tetanus bacillus, wounds of the soft parts may be closed by ordinary surgical technique with as high a percentage of healing *per primam* as by other methods.

A small dosage of staphylococci or attenuated contamination of the wound by the staphylococci after secondary excision and secondary closure does not interfere appreciably with the healing of the wound.

## AMBULATORY BRACES IN THE TREATMENT OF FRACTURES AND INJURIES OF THE LOWER EXTREMITIES

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PREVIOUS to the influence exerted by military surgery it may be said that the use of orthopedic braces following injuries and fractures of the lower limb was limited in America almost entirely to a small group of specialists chiefly those members of the profession familiar with orthopedic surgery in its most narrow scope. Following the experiences of the war many general surgeons and practitioners are taking back to civilian life varying ideas as to the usefulness and value of ambulatory apparatus in the late treatment of these lower extremity conditions.

It is not the purpose of the writer to argue the advisability or the advantageous benefits which may accrue from such appliances rather it is the desire to state briefly their scope of usefulness and discuss among the maze of models a few of the most serviceable examples from the point of individual application to various injuries.

Proper ambulatory apparatus may be of benefit in that it permits an otherwise bedridden patient to be up and about at the same time improving frequently his general as well as his local nutrition. Bone repair is hastened and regeneration stimulated through functional activity in accordance with Wolff's law. Further crutches may be abandoned with a resulting improvement in the patient's psychology. Over and above these considerations however remains the great outstanding fact that the incidence of deformity is materially lessened.

The contra-indications are largely a matter of good surgical and mechanical judgment manifestly weight bearing and mobility in the presence of active infection or active infection only recently quiescent are therapeutic aids of doubtful value. More important is the fallacy of ambulatory apparatus in cases of complete non union particularly those fractures accompanied by bone loss with the extremities not approximated.

Catalogues of private appliance makers contain frequently astounding examples of mechanical ingenuity and architecture but their intended usefulness is as doubtful and confusing to the medical mind as their accompanying specifications and directions. For the most part these appliances seem to be intended as agents for the correction of mal union and gross deformities.

More often than not such devices are not only orthopedically wrong but surgically unsafe. The dangers of extreme pressure exerted on a limb frequently devitalized need not be emphasized. Almost as a rule it may be stated that the therapeutic usefulness of any appliance is in inverse ratio to its weight and intricacy. The purpose of the following suggestions is to show that with a few mechanical principles borne in mind and a definite idea as to the therapeutic limitations (*vide infra*) mechanically perfect appliances may be ordered by the surgeon and constructed by any local mechanic. Regular appliance makers are better fitted no doubt to manufacture braces for permanent wear with such refinements as nickel-plated box joints and carefully finished leather work but braces made locally under the eye of the surgeon possess often the advantage of better fit and are less expensive. True if the surgeon is fortunate enough to have in the vicinity a skilled appliance maker his services should be utilized but locality is not a matter of serious concern as a great share of the army brace work has been done by commercial mechanic unfamiliar with any sort of appliance work.

Real impetus was first given to the use of ambulatory braces in the military service by our British contemporaries. Types of walking calipers and single irons with T straps were much used by British civilian practitioners and it was only natural that the braces became items of common use very early in their hospitals. With the American Expeditionary Forces and at home the ingenuity of American appliance makers while retaining mechanical principles was exerted in the direction of more standardization with the result that in the main the models described below represent selected and approved types of maximum simplicity.

Experience has shown that with the single exception of the round 5/6 Bessemer steel rod used in the distinctly British type of ankle brace with T strap (Fig. 1) the side rods of all ambulatory braces should be of commercial band steel 3/6 by 1/4 inch. The material is of ample rigidity for adult weight bearing and possesses the advantage of being easy to work. More expensive types of steel have the advantage of less weight but are

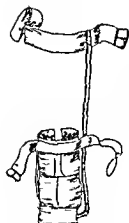


Fig. 1



Fig. 2



Fig. 3

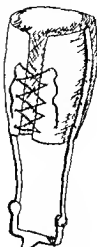


Fig. 4

Fig. 1 Ankle brace with T strap  
Fig. 2 Ankle brace with modified foot plate

Fig. 3 Side view of brace  
Fig. 4 Front view of brace

difficult to handle from the mechanic's point of view. Metal calf and thigh bands together with foot plates are cut from commercial sheet steel size 18 to 16 gauge depending on the weight of the patient and the purpose of the band or plate. Braces even before assembling present unusual difficulties in tempering and the method now employed at the Walter Reed General Hospital has proved extremely simple and entirely satisfactory. At the time of completion of the metal work the appliance entire is dropped into linseed oil; the oil is then burned off with a gasoline blow torch and the appliance plunged into cold water. The temper thus obtained is a slight added springiness. The process has the advantage of giving to the metal a dark non-rustable enamel like coat; the residue of the burned oil. All braces should be made to fit the part as snugly as is consistent with the mechanics; however as a rule uprights should not touch the leg and need not be padded. In the majority of instances webbing straps and covering serve as well or better than leather and are less expensive. Joints need not be forged and machined; experience has shown that  $\frac{1}{4}$  inch rivets are perfectly serviceable.

Ambulatory apparatus is indicated to relieve weight bearing, correct deformity, prevent deformity, limit normal ranges of motion and restrict abnormal ranges of motion. When ordering apparatus these five limitations must be borne in mind and a decision made as to exactly which among them apply to the individual case. No one appliance perhaps performs all of these functions nor is it necessary that it should. Certain of them are indicated; the others may be

disregarded but over this principle surgeons stumble more frequently than upon any other consideration relative to the prescribing of brace.

Figure 1 and 2 show two types of ankle brace. Neither model is suitable for weight bearing and should never be prescribed with that intention. As an example the use of either to prevent or limit angulation is common in the ununited fractures of both bones in the lower third of the leg would be to disregard the principles for which a brace is here indicated. The essential indication in this case would be relief of weight bearing. Both of the braces are of the single upright type and single uprights have the fault of rotating on the calf when the normal weight bearing column is broken; i.e. the femur and tibia are fractured. The weight then falls somewhat laterally on the single bar with a resultant twisting of the appliance on the limb leading to a dismal mechanical and orthopedic failure. Here follows the axiom that any weight bearing appliance must be of the double upright type.

The apparatus shown in Figure 1 has the advantage of being light, mechanically simple and particularly suited to the purpose of supination of the foot. It is not a popular model for it has several disadvantages. The T strap is apt to press over the malleolus. The heel and sole must always be raised on the inside. The upright is on the outside. It is further impossible to control flexion and extension of the ankle. And lastly the joint situated as it is in a plane 2 inches lower than the normal joint renders normal ankle motion impossible.

Figure 2 combines a modified Whitman foot



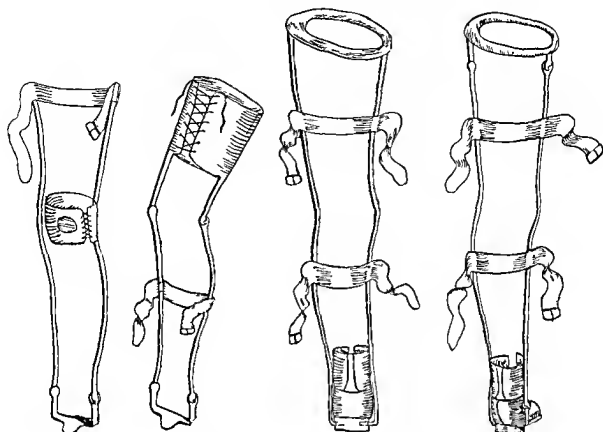


Fig 7

Fig 8

Fig 9

Fig 10

Fig 7. Tl gh b  
lg b Wght b  
th gh rs t nd t p

Fig 8. t h t b  
g th h br  
h h g l d

Fig 9. Tl gh b  
lg b Wght b  
th gh rs t nd t p

Fig 10. t h t b  
g th h br  
h h g l d

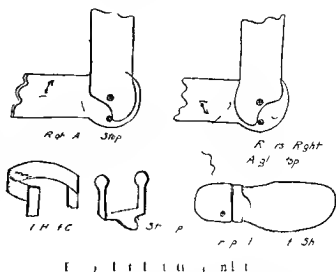
plate with a single upright and possess several commendable features. It may here be stated that other things being equal a single upright should always be placed on the inside. This situation gives greater comfort, a cosmetic improvement and is easier to adjust from the point of the brace maker. The foot plate of distinct benefit in those patients in whom long disease has so weakened the foot that flat foot is a complication to be feared and in cases of crural or destructive injuries to the tarsal and metatarsal. The plate together with weight bearing helps to restore the normal foot contour even in cases where ankylosis is the best anticipated result. Further pronation and supination together with flexion and extension may be controlled thus latter by the use of the stop. The top may be so arranged as to prevent plantar flexion beyond a right angle (Fig 9 right angle stop) or to prevent extension above a right angle (Fig 9 reverse right angle stop). This brace is

most frequently prescribed in injuries near the ankle joint where limitation of motion is the chief consideration and weight bearing may be borne by the foot if the weight is properly directed and the arch protected. The technique for making plaster impression of the foot preparatory to molding plate may be found in almost any textbook of orthopedic surgery and is extremely simple. The plate may be ordered from any reliable maker and the uprights added locally. There are certain cases where it would seem wise to limit weight bearing and still retain the foot plate. This may be accomplished by ordering the plate with both an internal and an external flange instead of just the single flange for attachment of the upright as shown in the illustration of the brace (Fig 10). The double upright type for weight bearing should conform in regard to uprights and cuffs to the design and construction detailed as applying to Figure 4.

Figure 3 illustrates the very common double

upright with stirrup brace for lower third leg and ankle injuries. This brace is one of the most useful and easily constructed of the many models. It is of particular value in the familiar inversion and eversion (Pott's) fractures of the ankle. The uprights it will be noticed are short extending only to the bulge of the calf. The calf band is a posterior metal half cuff of 16 or 17 gauge by  $1\frac{1}{4}$  inch sheet steel riveted to the extreme upper ends of the uprights. This cuff is completed in front by a leather or webbing strap. A word as to the use of encircling bands. All metal bands should be placed so as to half encircle the leg on the posterior surface never anteriorly. The band should be completed of padded webbing or leather in front. The extremities of the metal band should be riveted with two rivets at each end to the uprights to prevent lateral warping of the appliance when under strain (Fig. 9). The so called ankle braces should never be constructed with two metal bands should the surgeon feel that a second cuff is necessary about the circumference of the lower tibia the cuff is fashioned of pliable material only.

It is to be understood that the above model although of the double upright type is not intended and is totally unsuited to those cases requiring even partial relief from weight bearing. Figure 4 illustrates the only suitable ankle brace with which weight bearing is diminished or relieved with the possible exception of the brace previously described the foot plate with double side irons. It will be noticed that this model has a reverse right angle stop at the ankle longer up rights and that the posterior metal half cuff instead of being placed at the bulge of the calf is placed above that point at the level generally referred to as the garter circumference. Weight bearing is then taken by a firm laced leather cuff from four to six inches in width molded in the form of an inverted cone to fit the leg. This cuff when laced allows the swell of the calf muscles to engage in the cuff and when adjusted takes the body weight in a manner of an artificial limb or cone bearing socket. An important point is the adjustment of this laced cuff. The brace should be completed independently then the cuff unattached to the brace is laced snugly to the leg. With the brace held in position the patient is asked to bear weight slowly the proper position is then marked allowance being made for stretching and the cuff is riveted to the up rights. The absolute necessity of laced cuffs adjusted in the above manner cannot be too strongly emphasized. A point of equal importance and one even more frequently disregarded



is the question of joint in the weight bearing apparatus. It is well firmly impressed that a free joint at the ankle knee materially decreases the efficiency of the limb. A good example is the foot which is a truss of body weight in a high fracture of both bones of the leg might be made to follow. Double uprights placed cuff round the thigh knee joint with a rope top calf band ankle joint with rope calf band right calf attached to heel by a stirrup thus we have with the foot at right angles and the knee extended a rigid iron column however as the body is thrown forward and the knee flexed some weight must fall in the anteroposterior planes on the leg and thigh and it is doubtful if even a well fitting model would relieve of from over 60 per cent of the weight. Should the apparatus be constructed with free joints locked can only take place through muscular exertion and the weight bearing qualities are infinitesimal.

Figure 6 illustrates the appliance with knee and ankle stop that has just been mentioned as applicable to the relief of weight in high leg injuries.

This appliance with changes in the knee stop suggests it elf for a variety of conditions where the region of the knee joint is to be relieved of weight and the normal range of motion limited. In constructing thigh cuffs of the hinged type as is here used the same rules apply for adjustment of the weight bearing cuff about the calf.

Figure 5 may be considered an extended counterpart of the non weight bearing double upright ankle or leg brace as illustrated by Figure 4. This model is limited in use largely to the prevention and correction of lateral deformities about the knee in cases where weight bearing does not enter as a causative factor. Frequently an encircling cuff of pliable material is added about

the knee a hole cut over the patella to prevent pressure the knee joint of the splint made immobile and the cuff riveted to one side bar only. Thus it will be seen when the cuff is tightly laced exerts a strong lateral leverage either internal or external depending on the side to which the cuff is attached. For suitable cases a second cuff may encircle the calf and be riveted to the opposite side bar for the purpose of greater correction. Caution should be observed in the application of this lateral pressure or traction for it falls on the ligamentous structures of the knee and the least trouble some complication will be a stilted horn's nose. The illustration shows the knee cuff in position. However the appliance is most frequently prescribed without this attachment. The thigh band is a metal half cuff placed posteriorly and completed in front by leather or webbing exactly as described for the calf band laced on the ankle brace.

Consideration of the so-called walking caliper for patient recovering from fracture of the femur leads one to be domestic for perhaps more frequently than with any other appliance it is here that surgeons disagree regarding mechanical principles and are ultimately met with misfortune. More it is true that in fractures of the femur the ambulatory appliance is probably of the greatest value when properly designed. It may be stated that never is a simple union weight bearing walking brace of value to correct deformity incident to weight bearing where union is not yet firm. Weight bearing being the chief causative agent in the production of the deformity it follows then that relief of weight bearing is the consideration of maximum importance in choosing the model to be prescribed. Mechanically it is practically impossible and therapeutically it is actually wrong to attempt support from the upper fragment of the femur and this fact relieves us of any consideration of encircling thigh band and cuff. Weight bearing must be borne above the fractured femur and the logical as well as the point of election is the tuberosity of the ilium. The simplest device to secure

to this bearing is the Thomas ring snugly fitted. The use of an ordinary Thomas splint from which to construct the caliper while mechanically correct has first the disadvantage of round up rights. Pound uprights vibrate under the intermittent impulses of walking and may produce pain or interference with union. The first side bar previously described are to be preferred. Second the cannon in the heel has the disadvantage of forcing an unnatural ankle motion but this objection is almost nullified by the fact that this model (Fig. 7) has the very great advantage of taking more weight than any other type. Probably its capabilities in this respect when well fitted would exceed 9 per cent of the total weight borne by the normal leg.

Functionally it is unquestionably an improvement to displace the cannon in the heel for a stirrup with a reverse right angle stop and in suitable cases a joint with 180 degrees top may be inserted one inch below the Thomas ring permitting the ring to tilt when the patient is seated but locking when weight is transmitted through the ilium to the posterior half of the ring (Fig. 8). A necessary point to be considered

the pitch of the ring it will be remembered that the external bar of the Thomas splint is longer than the internal giving to the ring a downward bent from without inward. The angle thus formed is about 55 degrees. The preservation of this angle is essential to the proper mechanical function of all types of ring calipers.

In conclusion it may be said that each of the type of apparatus above discussed represent fairly standard and approved models designed particularly applicable to fractures perhaps but finding a distinct usefulness in a variety of other conditions that will suggest themselves to the surgeon. In every instance the three factors of cost simplicity and a maximum usefulness have been considered further the military necessity has thoroughly demonstrated the value of the apparatus and has placed the use of ambulatory brace in fractures far beyond the point of experiment.

# THE INTERSTITIAL TRANSPLANT OF THE ROUND LIGAMENTS IN THE TREATMENT OF SPICULATED CASES OF UTERINE RETROVERSION

BY WILLIAM WARDLOW, M.D., COLUMBIA, OHIO

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IT is my purpose in this communication to describe treatment of retroversion of the uterus by a surgical method which I have devised and have been employing for the past four or five years in my gynecological clinic in the Medical Department of the Ohio State University and also in my private work.

In my hands and in those of several of my assistants as well as a few of my professional friends who have done me the honor to adopt it as their method of choice in properly selected cases the procedure has given exceptionally good results.

## TECHNIQUE

This technique is made possible by a simple instrument devised by the writer which he has seen fit to designate by the name hysterotome. This instrument consists of a blade or needle of curvatures length and other dimensions which are best suited to the purpose for which it is intended namely to make a passage in certain curved directions through the uterine wall. It is fitted with cutting edges at its point only while the shaft of the instrument consists of a rounded dilating or non cutting portion. These blades are made in three sizes for use in the various classes of cases encountered and are fitted with an interchangeable handle which permits of shifting the direction of the blade at convenience of the operator to meet the exigencies which arise during the operation.

The steps of the operation are as follows:

The abdomen having been opened in the median line the two round ligaments are caught at such a point that they will be on an easy tension when they are approximated directly across the pelvis (Fig 1). At this point a suture ligature is applied tied and left long. This point of approximation is supposed to be the place at which the fundus of the uterus is finally to be suspended when the two ligaments are tied together as the final step of the operation. The ligaments when stretched across the pelvis should not be tense but should be adjusted at a degree of easy tension to allow the recognized mobility of the fundus within the normal physiological limits.

The displaced uterus having been raised in the pelvis the point of the hysterotome is inserted

into the tissue as nearly as possible at the point of origin of the round ligament on the anterior surface of the horn of the uterus. Theoretically the point of insertion is exactly at the point of emergence of the ligament from the uterine wall but practically I have found it best to choose a point corresponding to the exact margin of the ligament as it emerges from the uterine horn at its inner and lower aspect. Inserted at this point the instrument is pushed directly backward through the uterine horn and in under the interstitial portion of the tube. When the instrument has reached a point beyond the tube its direction is turned downward and inward traversing the posterior wall of the uterus in a downward and inward direction to a point in the median line and at once it is below the tunica albuginea. Here the instrument is made to emerge in the posterior aspect of the uterus. The exact hysterotome is then threaded with a fine silk suture which is drawn back through the newly made passage by with drawal of the instrument. This serves the newly made passage with the traction loop in place throughout its entire length. This same procedure is then followed on the other side of the uterus the point of the hysterotome being made to emerge from the same opening on the posterior surface as it did at the first passage on the opposite side. We are now ready to transplant the ligaments to their new position and the remainder of the procedure is simple. The ends of the traction ligatures are each drawn through its corresponding passage by means of the loops and in turn each round ligament is drawn into its new position (Fig 3). As the ligaments are drawn through the uterine walls the uterus is manually ruled into its normal position. Traction is continued until the ligated points of the ligament appear in the puncture opening. The traction ligatures are now tied together cut short and the knot allowed to drop back into the uterine wall through the small puncture opening (Fig 4).

If the hysterotome has been passed with accuracy and its point made to emerge in each instance through the same opening on the posterior surface of the uterus no further suturing will

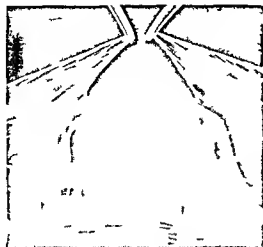


FIG. 1. Incision through the abdominal wall, showing the underlying structures. FIG. 2. Incision through the abdominal wall, showing the underlying structures.

FIG. 3. Incision through the abdominal wall, showing the underlying structures. FIG. 4. Incision through the abdominal wall, showing the underlying structures.

be necessary. In some instances, however, it may be thought best to suture the puncture wound in which case a No. 10 plain catgut suture may be used.

In the case in which one or both tubes have been moved the same technique may be used. In such a case the ligament is transplanted through the hernia of the uterus at the point where the tube has been removed. The advantage lies in the absence of stitches with consequently less tendency to form adhesions with the peritoneal surface of the uterus.

The reason which led to adoption of the technique just described are as follows. During the year from 1891 to 1900 the writer conducted a series of experiments with the object of ascertaining first the actual strength of the round ligament as a whole in different individuals and secondly the comparative strength of the muscular and tendinous portions of each ligament. The experiments consisted in the excision of the neck of round ligament to ten centimeters from the uterine fundus in ten subjects except in one instance of a thin girl in which the subject was very young. The subject was killed by a lethal dose of morphine after a general death. The autopsy was performed immediately within 6 hours after death.

The first part of the inquiry resulted in no data of any value the different specimens showing such a wide variation in strength as not to be comparable. The result of the second part of the

investigation, however, seemed to me of much greater importance. In every instance the ligament stretched and finally broke in the muscular and never in the fibrous portion.

In the living subject I have repeatedly demonstrated that the tendinous portion of the round ligament is stronger than the muscular portion. During hysterectomy in those cases in which the round ligaments are not materially affected by disease the operation is performed in the usual manner with the exception that the upper portion of the broad ligament was left intact and the ovarian drawn for it by backward along the undivided structure including the upper part of the broad ligament as well as the round ligament to break at any point between it and its attachment. In more than 30 cases subjected to the test the round ligament with one exception have broken in the fleshy portion.

Because of the experiment I have always preferred the operation of choice the method which uses the fibrous and not the muscular portion of the ligament for its supporting medium.

Further as my experience in the surgical treatment of retroversion has widened another essential has seemed to be lacking. A careful review of the entire field of operative procedure for the cure of this condition failed to reveal any method with the exception of the old Alexander Adams operation and one or two of its modifications which attempts to utilize the sustaining action of the round ligament strictly in the



Fig 3. The ends of the tract in ligatures are each drawn through the corresponding passage by means of the loops and in turn each ligament is drawn into its new position.



Fig 4. Tract is introduced with ligated point of the ligament placed in the new position. The traction ligatures are tied cut here and the knot will well be back at the old position all through the junction.

direction of their origin and insertion without which line of traction it is impossible for these structures to act physiologically. Such abnormal line of traction must result in undue tension which is more or less continuous. No tissue of the body is so constructed as to be able to maintain a condition of continuous tension and such a state must inevitably result in stretching and atrophy of the overworked ligament or pain to the patient or both.

Furthermore it has seemed desirable to avoid as much as possible the use of suturing or other trauma of the peritoneum in making the new attachments since the liability of adhesions with the accompanying complications is directly in proportion to the amount of suturing or trauma made necessary by the technique used.

#### ADVANTAGES

It is upon the foregoing observations that the interstitial transplant of the round ligament has been devised. Thus far this method has shown the following advantages:

1. The round ligaments are utilized to exert traction strictly in their anatomical direction. Thus the operator has imposed upon them no undue strain which in turn favors a physiological and comparatively painless convalescence.

2. The utilization of the stronger tendinous portion of the round ligament as a supporting structure lessens the danger of recurrence as far as relaxation of the structure is concerned.

3. No encroachment upon and consequently no strangulation or distortion of the lymphatic

vascular or nerve structures lying between the layers of the broad ligament.

4. No adhesions or artificial bands stretching between the uterus and the abdominal wall in front with consequently no danger of strangulation of the intestine through the apertures so formed.

5. Minimized trauma. The elimination of suturing on the posterior uterine wall lessens liability to the formation of adhesions as compared to all other operations in which there is extensive suturing of the round ligaments to the posterior uterine surface.

6. During pregnancy the transplanted portion of the ligament being muscular partakes of the hypertrophy of the uterine wall and adjusts itself accordingly to the physiological change.

7. The operation is simple and reduce to a minimum the question of the personal equation in different operators. By following literally the various steps of the technique the operation can be performed by operators of different degrees of skill with equally good results.

I have frequently been urged to publish my technique for suspension of the uterus but have been unwilling to do so until enough time had elapsed and a sufficient number of cases had been operated upon to bring out and test the essential points which would demonstrate the value of the procedure. In the meantime I have been content to work out the desired end by demonstrating the method in its various stages of development in my operative clinic and to my professional friends.

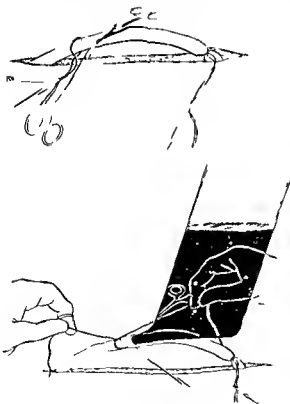
These essential points are (1) permanence of

## SOME AIDS IN THE TECHNIQUE OF BLOOD TRANSFUSION BY THE PARAFFIN TUBE METHOD

B. THOMAS I. SHUTE, M.D., C. L.

**I**N a large number of blood transfusion performed in a British Casualty Clearing Station and in private practice the importance of the following points have emphasized themselves in facilitating the transfusion of blood:

1. A well paraffined tube.
2. Sharp dissecting instrument.
3. Exposure of both the recipient and donor of at least an inch of vein with well branches. If branches appear in the exposed portion they should be tied.
4. A properly applied tourniquet on the donor.



I d S t m t d l l T r m s t l d l T r i g i B l i T f b d P m T b M d l S l f

5. A few ounces of 5 per cent sodium citrate ready on the table to be used as directed below for the prevention of clot in the tube. The tube should be dipped in the citrate solution before it is inserted in the vein. When the tube is refilled three or four times a small fragment of clot may remain adherent to the side after it has been emptied. This small clot will form the nucleus of a larger clot and make the injection of the contents of the refilled tube quite difficult or impossible so that a second tube will be required and from 100 to 200 cubic centimeters of good blood may be lost. This difficulty will be obviated if a few cubic centimeters of the citrate solution are injected into the large opening of the venous tube and shaken for a minute after which the citrate solution is allowed to run out taking any small particles of residual blood with it.

This simple procedure will also prevent the injection of clot into the vein with the subsequent danger of thrombosis.

Blood clotting in the vein of the patient with bilateral pleure and the consequent delay in opening a new vein each time a tube is filled are prevented by having a gauze pad saturated with a 5 per cent solution of sodium citrate on the exposed vein of the recipient immediately after the lumen has been opened and returning it in place while the tube is being filled from the donor.

By the use of a small amount of citrate in this way whole blood and nothing but blood is given the patient. It is not necessary to mix any citrate or any other substance with the blood to be injected.

6. The accompanying cut shows how a closed connection prevents any reurgitation of the blood between the vein and the tube can be made by crossing a linen suture around the vein and tip of the tube.

In the transfusion of blood more than in any other operation the careful attention to small details assures an easy and successful operation rather than a total or partial failure.

## PRE OPERATIVE AND POSTOPERATIVE TREATMENT TO PREVENT RECURRENCE OF STONE FOLLOWING NEPHROLITHOTOMY

BY A J CROWELL M D F A C S AND RAYMOND THOMPSON M D CHARLOTTE NORTH CAROLINA  
Orth C HU 1 g 1 C1

In reviewing the literature of nephrolithotomy one is struck with two facts first the high percentage of recurrences of stone and second that no one has offered a definite or plausible plan of treatment to prevent their recurrence.

It is generally admitted that infection trauma or any condition producing hemorrhage are predisposing causes to nephrolithiasis. The necrosis accompanying infection or clot following trauma or hemorrhage from whatever cause forms a nucleus upon which the salts of the urine are deposited.

Much has been written on the subject of pyelitis and its treatment by pelvic lavage with the various antiseptic solutions and especially nitrate of silver but no one seems to have thought of this as a routine preparation for operation and after treatment as a means of preventing the reformation of kidney stone.

In practically every case of nephrolithiasis calling for operation we have to deal with kidney infection as well. In such cases the elimination of the infection before operation is very important if we are to obtain the best results possible. This cannot always be done but when it can two things are accomplished first union by first intention is made possible and second the recurrence of stone is rendered less probable. This plan of preparation could be efficacious only in cases of infection where the stone is located in the kidney pelvis. Practically all renal calculi primarily are located in the kidney pelvis.

This is certainly true with the exception of those cases associated with tuberculosis of the kidney and those call for nephrectomy.

The statistics given by Cabot and Crabtree cover operations for stone in the kidney and ureter at the Massachusetts General Hospital for 8 years previous to January 1914. The list includes 155 cases but only 87 of these were carefully examined at the clinic to determine the post operative results. Of these 87 cases 66 were operated upon for stone in the kidney and 21 for stone in the ureter. Of the kidney cases 34 or 51 per cent were not well 32 or 49 per cent were well. Classified according to type of operation 30 cases of nephrotomy show 13 or 43 per cent well and 17 or 56 per cent not well. In 33 cases of pyelotomy, 16 or 49 per cent were well and

17 or 51 per cent were not well. We see from this that the better results were obtained by pyelotomy. This we believe is a perfectly natural result since hemorrhage following nephrotomy is more profuse than following pyelotomy and the probability of clot retention greater. Infection following nephrotomy certainly is more likely to occur.

Their conclusions are that in operations for kidney stone the probability of recurrence is considerable that it depends somewhat upon an entirely unknown factor—the ability or ability of that particular kidney to form concretions. These authors state that in their opinion infection is not a factor of overwhelming importance in the formation or recurrence of kidney stone. In the last two conclusions we do not concur but adhere to the theory of infection and hemorrhage as predisposing cause to stone formation.

Bransch of the Mayo Clinic concludes after a study of 88 cases operated upon there that about 10 per cent have recurrences. Frayer of London believes that recurrence is so frequent that non surgical interference is the better policy to pursue unless decided symptoms are present. He believes that recurrence is almost inevitable.

Such divergence of opinion from men of their prominence and clinics of such wide reputation is proof positive that enough work on the subject has not been done to make the present statistics of value as to the frequency of recurrence. Practically nothing has been suggested to prevent their reformation.

The above mentioned plan of treatment occurred to us while working out the following case.

Mrs S age 43 Complaint pain in the back. The family history was negative. The patient had had the ordinary diseases of childhood with no complications. She was married at the age of 20 and has 3 healthy children. No history of typhoid fever or any illness which would act as a predisposing cause to nephrolithiasis was obtained. The patient began to suffer with severe pain in the back about 8 years ago. These attacks occurred at frequent intervals and were accompanied with pain, chills, loss of appetite, etc. Occasionally hematuria was present during an attack. The pain in the back was aggravated by motion. For the past 6 months there has been slight frequency of urination. Two weeks ago the patient had a severe attack of colic chills and high fever.

Examination. The patient had an anxious expression. She was anemic and had no deformities. The eyes





The following measures were therefore taken in the hope of curing the gonorrhea and causing the abscess to contract in size or granulate sufficiently to obliterate the cavity. The patient was instructed to avoid alcoholic beverages and sexual activities. He was instructed to inject with 10 per cent protargol four times a day. Every day the urethra and bladder were irrigated with the same solution and the prostatic vesicles and abscessed area thoroughly massaged followed by another irrigation. The irrigations were given with a 150 cubic centimeter Janet Frank syringe (no catheter being used).

With this treatment the gonococci disappeared rapidly from the urethral and prostatic pus and in one month the contents of the abscess cavity were reduced to about one dram of thin pus. As the condition then remained about the same for some time it was decided to examine the posterior urethra to see if possible the location of the abscess opening.

September 17 1916 Cysto-urethroscopy showed normal bladder trigone and urethral orifices. The posterior urethra presented moderately enlarged lateral lobes and large patulous prostatic duct openings. The verumontanum was large and congested with a deep utricle. No pus was seen coming from any duct opening but slight pressure exerted on the abscessed area through the rectum caused thick pus to well up from the sulcus to the right of the caput the latter enlarged body apparently overhanging and hiding the actual orifice from view.

September 6 1916 An ordinary posterior urethroscopic tube was passed in the hope of being able to pass the jaws of a long thin alligator forceps into the opening of the abscess. This was entirely unsuccessful as the caput occupied most of the field and I did not care crudely to plug it through this structure and the wall of the posterior urethra and perhaps miss my objective.

Soon after this examination (October 1916) protargol therapy was stopped but gonococci reappeared and treatment had to be resumed. The pus from the prostatic abscess now showed bacteria other than gonococci (secondary invaders) as did also the mucoid urethral discharge.

On January 30 1917 about 7 months after beginning treatment protargol therapy was again stopped. I repeated careful examination of the urethral discharge strands and prostatic secretion revealed no gonococci although other bacteria (all gram positive) were present. The patient was now instructed to inject three times daily with 20,000 corrosive sublimate and 10 grains of urotropin. I prescribed three times a day.

Although the gonorrheal infection had been overcome the secondary infection caused persistence of the prostatic abscess which yielded about two drams of thin pus on massage. The drainage was apparently insufficient to secure the desired results.

It seemed imperative therefore to improve the drainage by enlarging the intra urethral opening of the abscess and with this object in view Leo Buehr was consulted. His cysto-urethroscopic examination February 26 1917 revealed the same picture which I had found five months before. He suggested and performed the rongeur forceps removal of that part of the verumontanum overhanging and hiding the abscess opening. This opening we found smaller than anticipated and a week later it was enlarged by means of the scissor forceps through the operant cystoscope.

I then continued along this line of therapy. At intervals of ten days the operating cystoscope was passed the opening into the abscess was stretched by passing through it

the dilating olive of increasing size. Following the dilatation a No. 7 urethral catheter was passed well into the cavity. The latter thoroughly irrigated the abscess cavity with a 1,000 mercuric bichloride solution. After one of these treatments a mild epididymitis occurred in the right testis which subsided in a week.

It was observed that whereas it was formerly necessary to exert pressure through the rectum in order to demonstrate the prostatic abscess cavity there was no spontaneous drainage through the enlarged urethral opening of the abscess. The urethral discharge diminished markedly and finally ceased. The urine which at first because of the establishment of pontine drainage became more turbid became much clearer and the abscess cavity diminished in size.

On May 9 1917 the following is the status. No urethral discharge first urine clear with a few dried second urine clear right testis feels normal left testis atrophied as originally noted. Pectal examination both vesicles irregular firm but small and not indurated left prostatic lobe same that enlarged yielding thin watery fluid with a few leucocytes on massage right prostatic lobe smaller than left and retracting and precluding lower pole thus representing former abscess. Massage of the urethra yields six or seven drops of thin yellowish hazy fluid showing a few pus cells and some granular deposit streptococci.

On June 19 1917 cystoscopy examination showed normal bladder urethral orifices a slight enlargement of the caput of the urethra large opening into the abscess cavity fluid drained from the abscess.

On October 19 1917 examination showed no discharge urine clear with a few leucocytes. He felt well and looked well. Massage of the prostatic vesicles revealed strands of thin fluid which showed a few pus cells and mucus. He had had no treatment for a month and as cured of both his gonorrhea and his prostatic abscess. I attached no clinical importance to the light red color of the urine as it is present. His usual symptoms however still persisted.

According to McCarthy the majority of prostatic abscesses begin close to the deep urethra. Of 104 cases 74 opened spontaneously into the posterior urethra producing single multiple or crabiform openings. Of the 74 cases 7 per cent subsequently developed serious complications and the author therefore advocates incision and drainage through an inverted incision in the perineum. I concur heartily with his plea for conservation of the urethra avoiding the operations of Alexander and Proust. Incision through the rectum is of course the last possible choice of procedure.

It is in the group of cases which evacuate spontaneously into the urethra and which suffer from continued infection due to insufficient drainage that intra urethral procedures such as detailed in the case above find their field of usefulness. Massage alone will not effect a cure.

Crockett in 1917 published a technique for obliteration of persistent prostatic abscess cavities using the ordinary posterior urethra

scope The method appears to be exceedingly difficult of application necessarily inaccurate and too coarse for safe use in a complicated structure like the posterior urethra The development of the operating cystoscope and cystourethroscope however makes the procedures employed in my case exceedingly safe accurate and effective It was surprising how readily the posterior urethra accommodated and tolerated the operating cystoscope the Albarran deflector and the various instruments

passed through the cystoscope Even local anesthesia was unnecessary Crockett's technique could not have been employed here as my failure in attempting a similar mode of attack proved

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## COCCYODYNIA

### FURTHER EXPERIENCE WITH INJECTIONS OF ALCOHOL IN ITS TREATMENT

By FRANK C. YEOMANS, M.D., F.A.C.S., NEW YORK

**I**N a communication to this society in 1914 entitled *Coccygodynia: a New Method of Treatment by Injections of Alcohol* the writer reported seven cases relieved or cured. The leading symptom is pain in the region of the coccyx. At this time it will suffice to recall the theories of causation of this pain.

1. *Neuralgic theory* (Marro, Pozzi and others) that an initial trauma caused violent nerve irritation which persists without any demonstrable anatomical nerve lesion.

2. *Neuritis* as occurred in twelve cases of labor from pressure of the foetal head on the terminals of the sacral plexus (Graefe).

3. *Theory of injury* of the coccyx resulting in fracture, dislocation, ankylosis or caries.

4. *Symptomatic* i.e. a referred pain of central origin due to many functional or organic diseases of the central nervous system as hysteria, neurasthenia, irritable spine, the traumatic neuroses, tabes dorsalis, toxæmia, or it may even be a habit pain.

Theories one, two and three are based on trauma and comprise the major number of cases while the few remaining are symptomatic which accords with clinical experience. In fact a history of trauma within the pelvis as in difficult labor or external violence most commonly a fall is so often responsible for the condition that searching inquiry must be made in every case. Rarely there is a gross lesion of the coccyx but as a rule the injury affects the periosteum alone and the soft structures adjacent or attached to the bone—muscles, fascia, ligaments and nerves.

The nerves composing the coccygeal plexus are

the fourth (mostly) and fifth sacral, the coccygeus and (probably) the inferior hæmorrhoidal branch of the internal pudic. There are also on the anterior surface of the coccyx two ganglia of the sympathetic connected to each other by fine nerve filaments and by other filaments to the last sacral ganglion of the chain which constitutes the pelvic sympathetic (Hamant and Pigache). Quite naturally then irritation of any part of a nerve plexus so intimately related to the central and the sympathetic nervous systems will elucidate the protean disturbances of sensation occurring in coccygodynia.

The coccyx is surrounded by compact structures largely fibrous which the delicate network of nerves traverses. Injury of these structures initiates an inflammatory reaction with proliferation and later contraction of the new fibrous tissue and compression of the nerves.

Fracture or dislocation of the coccyx may cause pressure pain. Pressure upon the nerves by the bone or contraction of the injured soft parts produces neuralgia. If the pressure is maintained neuritis may occur or neuritis may take place from the beginning if the trauma is of sufficient severity.

**Symptoms.** The chief symptom is a characteristic spasmodic aching pain usually localized in the region of the coccyx aggravated by rising and seldom affected by urination or defæcation though constipation is usually present. While it may be a symptom of a hysterical condition conversely in the writer's opinion coccygodynia long continued may result in neurotic state.

*Diagnosis* is made by a thorough examination both general and local. The former embraces the spinal column to discover injury or disease and the nervous system to exclude tabes dorsalis, hysteria, the neuroses, etc. The local examination is made with the patient in the Sims' posture. The index finger is passed into the rectum and the coccyx grasped between it and the thumb outside. Thus the position, contour, mobility, and tenderness of the coccyx can be determined at once. Next the soft parts just distal and then lateral to the tip of the coccyx are compressed between the examining fingers. The patient will usually cry out with exquisite pain when the affected portion of the coccygeal plexus of nerves has been squeezed and the pathognomonic symptom elicited.

Lesions of the anal canal and rectum simulating coccydynia are to be excluded. The most common of these are anal fissure, inflammation of the crypts of Morgagni (cryptitis), hypertrophied anal papillae, blind internal fistule, proctitis, thrombosed hemorrhoidal veins, and foreign bodies in the rectum. In women an examination of the external and internal genitals is made and in men the prostate, seminal vesicles, and urethra are examined to exclude pathology which might cause reflex pains.

*Prognosis.* In general the prognosis is good. I am aware that this statement is at variance with past opinion but believe that failure in most cases was due to the erroneous idea that the pain resided in the bone rather than in the nerves.

*Treatment.* The many methods of treatment that have yielded varying degrees of success are the best evidence of their unreliability.

Excision of the coccyx is a simple operation but should be reserved for those cases in which it is diseased or deformed or after the injection treatment has failed. The fact that in some cases the pain persists after removal of a clinically normal coccyx and is relieved in others indicates that in those which were relieved the nerves were excited together with the bone. Even in cases of neuralgia or neuritis from pressure due to deviation of the bone, injections which are simple and harmless should be tried before excision.

The treatment employed by the writer is an application of the principle of injecting sensory nerves with 70 to 80 per cent alcohol thereby causing their degeneration as suggested by Schloesser in 1907 and practised with marked success by him and his many followers particularly in neuralgia of the trifacial nerve.

*Technique.* The injections are made easily at the office under strict aseptic precautions. The

patient assumes the Sims' posture and the region of the coccyx is painted with tincture of iodine. An aseptic syringe of cubic centimeters capacity is filled with 80 per cent alcohol and armed with a 1/2 inch needle of fine gauge. With the index finger in the rectum the point of maximum tenderness is determined by counter pressure with the thumb outside. Usually this is just distal to the tip of the coccyx or slightly lateral to it. Maintaining the finger in the rectum as a guide and to guard against its puncture the needle is inserted through the skin in the midline directly to the tender point. When this is reached the patient may exclaim from exquisite but tolerable pain and 10 to 20 minims are injected slowly. The needle is withdrawn quickly and the iodine on the skin is neutralized with alcohol. The pain from the injected alcohol lasts a few minutes only but a dull ache may persist for 24 hours. A single injection has cured a few cases but generally owing to the broad distribution of the coccygeal plexus of nerves one to ten treatments with an average of three or four has been necessary. The interval between injections should be from five to seven days and the solution is always kept until the point found most tender at the time of injection.

Since my report in 1914 of seven cases I have had 11 cases making 28 in all. Four of these including one fractured coccyx were not treated. Of the 4 treated cases 20 were females with an average age of 35 years and 4 males average age 39 years.

External trauma was responsible for the condition in 15 cases: a fall in 13 of them, internal injury (difficult labor) in 3, two followed local operations and in four the cause could not be determined. Thus trauma was the causal factor in over 80 per cent of the series.

The duration of the pain before treatment was from 3 weeks to 15 years averaging 2 months.

The site of tenderness was just distal or distal and lateral to the tip of the coccyx in all cases.

The coccyx felt normal in 20 cases, was directed backward in one, forward in another, ankylosed in one and had been excised without relief in one.

The number of injections varied from one to ten, average four.

*Results of treatment.* Clinically cured 16, relieved 7, failed 1.

Elapsed time since treatment varies from 3 months to 9 years. Relief for several years justifies the expectation of a permanent cure.

In one patient in whom there was failure to cure after 10 injections the coccyx was resected with complete relief.

# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN SURGERY

A young medical man who had just finished his internship the reviewer called one morning many years ago on Dr. Christian Lenger to ask him for a few minutes about the new medical literature. When he had learned the purpose of my visit Dr. Fenger asked me to wait for a few minutes until he was ready saying that he would then take me back to my part of the city in his buggy. Presently he seated me in a very comfortable and unduly safe and elderly horse.

After he had answered my questions he fell into conversation with me about the new multi-plectic surgeons (and their accused polytechnic university professors) that to-day look so operating rooms of our illustrious hospital. He earnestly insisted on cutting and sewing and no English in surgery and operating without caring to investigate the merits of what he had learned. Some of these gentlemen accused the bellicose Dane of being a pathological student and no practical surgeon. A real surgeon had no time for the labor to write the book as too fallible an apparatus to be consulted in the emergency. As he deplored the attitude of the then recognized leaders of American surgery his wrath grew with his discussion and thinking of the attributes he had seen perpetuated he exclaimed: "I'll do surgery with any of the damned practical fellows I'd wish that he got his general at me and live draped before the Court of Honor."

If this is a man of the Fenger type—a man who finds his greatest satisfaction of the professional net in the past and luculation of the details of pathology, well in the conque of technical difficulties in the satisfaction of a day spent in the life of suffering and in honest study as well as of the hour spent in the limelight before the medical multitude.

The theoretical practice of peritoneal surgery enters so closely related as they should be. The knowledge that like a great monograph of science at once perfects and satisfies the setting in the place of quiet and loving study rather than of greed of attainment.

The student must consider the structure and function of the peritoneum in relation to the principle of abdominal surgery. The second volume is devoted to the indicated practical side of the subject and is the subtitle *Deas and Their*

*Treatise*. The first volume is replete with the practical laboratory studies of the author controlled by a wide surgical experience. The second volume is clinical and yet is influenced in every paragraph by the writer's experimental studies of theory and principle.

In the second volume peritonitis and other peritoneal diseases are considered first in general terms and then with special and very definite illustrative studies. The reader may be confident that no important contribution to our knowledge has escaped inclusion in these chapters—the excellent illustrations are themselves worthy of careful study. Even the experienced surgeon finds satisfaction and interest in studying them while the novice may easily obtain through them the fruits of lifelong study summed up in a page.

The subjects of appendicitis and of the peritoneal troubles due to gall stone disease are utilized as paradigms for the study of the behavior of the peritoneum and its inflammation. Here especially the beginner finds rich material.

The diseases and injuries of the omentum and the tumors of the peritoneum are the subjects of the final chapters.

This work is a *sit qua* for the surgeon. It should be read through many editions and be translated into languages other than English. We need many monographic works of the type of this book. The great monographs of surgery that have impressed us give us cheer for our course in professional life. MacEwen could study head surgery and filled his ward with selected cases. Ollier can not be forgotten for his bone work. Woeifler and Kocher were the pioneers in the cure of goiter. Courvoisier and Kehner gall stone disease while Billroth in gastric surgery and in the principles of surgery gave us a complete and vividly colored study and taught us monographs of value infinitely in excess of the mere facts presented. No man is a finished surgeon but only a student of *diene* in the operation of a man who has not drawn inspiration from the monograph criticism of such great men. It is not only with such men have contributed in knowledge and technique that should seek and prize but also that they see and how they ought should be rewarded by us as priceless assurance.

Young men learn from this work. At thirty years of age I began to study some large topic of surgery and published a book on the subject at forty five or fifty. But work!

WELLER VAN HOOK

T. F. F. A. S. F. R. L.  
By Author. E. H. R. M. D. F. A. S. C. S.  
L. C. M. L. C. M.



the development of the field of orthopedic surgery. The mass statistics have to be not become available nevertheless one is confident that the new findings sign the maimed and crippled. How could it have been prevented and how can they be returned to society as an asset and not a liability? Comparative few definite steps in advance have been taken in recent years in orthopedic surgery until the Great War, as in full swing then it became suddenly apparent that something must be done. The recent record is on of

A. T. M. O. M. S. By Roy I. W. M. M. D.  
N. R. C. S. (E.) F. A. C. S. 6th ed. h. h. d. Ph. D. 1918  
D. N. Y. k. L. & F. b. g.

Whitman's selection is a forerunner of what we may expect in the near future. In the past the volume was the essence of our knowledge of orthopedic surgery. The new edition retains the priceless information to which has been added the more recent work done in paralysis such as due to poliomyelitis and includes a chapter on military orthopedic surgery. This latter subject is more or less in brief form and needs expansion and detail. This can be given only after results have been ascertained. This volume is exceedingly well illustrated and the text is interestingly phrased.

J. A. WOLFER

## CORRESPONDENCE

### CHOICE OF OPERATION IN CHRONIC GASTRIC AND DUODENAL ULCER

*The Editor*—I the article which appeared the September number of this magazine from the pen of Mr. Wilton the statements made that double gastrojejunostomy is advocated by me for the treatment of this condition. I have never recommended this operation as the routine treatment of cases of hour glass stomach.

In the article of mine from which he quotes it was described as the treatment of those cases in which pyloric stenosis was present in addition to the obstruction in the body of the stomach—a rare complication (4 out of 60 cases).

In a Cont but in to the Discussion on the Choice of Operation in Chronic Gastric and Duodenal Ulcer published in this magazine in No. 4, I wrote: "When hour glass stomach has supervened gastrojejunostomy on the entral side of the obstruction—glf there is no obstruction only double if only the most satisfactory operation. This is different from a partial gastrectomy as in the latter this is not the case."

In most of the cases of hour glass stomach the ulcer produced the obstruction is adherent to surrounding tissues partially the pancreas and need little treatment. The following table of the operation carried out in the 60 cases of simple hour glass stomach which have been under my care illustrates this.

|  | Case | D. h. |
|--|------|-------|
| Partial gastrectomy  | 39   | 4     |
| Single gastrojejunostomy with excision of ulcer in 5 cases | 26   |       |
| Double gastrojejunostomy                                   | 4    |       |

So far from regarding double gastrojejunostomy as the operation of choice I carry it out only in the exceptional cases mentioned.

JAMES SHERREN C. B. E. F. R. C. S.

L. d. E. g. l. d.

### RELATION OF METHOD OF ADMINISTERING PARATYPHOID VACCINE AND ONSET OF ACUTE APPENDICITIS

*The Editor*—In my article entitled "Immediate Surgical Management of Acute Appendicitis in Military Hospitals" published in SURGERY GYNECOLOGY AND OBSTETRICS in March 1909 I inadvertently did not mention the name of Dr. M. L. Moise of the Laboratory Service, Camp Pike Base Hospital as being one of the first medical officers to suggest the possibility of a relationship between the effect caused by the method of administering paratyphoid vaccine and the onset of appendicitis. The name of Dr. Morris is mentioned in connection with a report on the pathology of the appendix of one patient. I am glad therefore to take the opportunity to give him credit for his suggestions.

HUGH MCKENNA M. D.

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